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OF THE

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SESSION 1912-13

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1. Report of the Auditor General for the year ended 31st March, 1912 Volume I, Parts A to J. Volume II, Parts K to U. Volume III, Parts V to Y. Presented by Hon. Mr. White, 14th January, 1913.

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2. The Public Accounts of Canada, for the fiscal year ended 31st March, 1912. Presented by Hon. Mr. White, 26th November, 1912.

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3. Estimates of sums required for the service of the Dominion for the year ending 31st March, 1914. Presented by Hon. Mr. White, 3rd February, 1913.

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4. Supplementary Estimates of sums required for the service of the Dominion for the year ending on the 31st March, 1913. Presented by Hon. Mr. White, 10th March, 1913.

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7. Report on dividends remaining unpaid, unclaimed balances and unpaid drafts and bills of exchange in Chartered Banks of the Dominion of Canada, for five years and upwards prior to 31st December, 1911. Presented by Hon. Mr. White, 26th November, 1912.

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10. Report of the Department of Trade and Commerce for the fiscal year ended 31st March, 1912. (Part I.—Canadian Trade). Presented by Hon. Mr. Foster, 30th January, 1913. *Printed for distribution and sessional papers.*

10*a*. Report of the Department of Trade and Commerce, for the year ended 31st March, 1912. (Part II.—Canadian Trade with (1) France, (2) Germany, (3) United Kingdom, and (4) United States). Presented by Hon. Mr. Foster, 12th December, 1912. *Printed for distribution and sessional papers*

10*b*. Report of the Department of Trade and Commerce for the fiscal year ended 31st March, 1912. (Part III.—Canadian Trade with Foreign Countries, except France, Germany, the United Kingdom and United States). Presented by Hon. Mr. Foster, 15th January, 1913.. .. ..*Printed for distribution and sessional papers.*

10*c*. Report of the Department of Trade and Commerce, for the fiscal year ended 31st March, 1912. (Part IV.—Miscellaneous Information). Presented by Hon. Mr. Reid, 17th Febrnary, 1913.. ... .*Printed for distribution and sessional papers.*

10*d*. Report of the Board of Grain Commisioners for Canada. Presented by Hon. Mr. Foster, 3rd February, 1913.. .. ..*Printed for distribution and sessional papers.*

10*e*. Report of the Department of Trade and Commerce for the fiscal year ended 31st March 1912. (Part VI.—Subsidized Steamship Services). Presented, 1913. *Printed for distribution and sessional papers.*

10*f*. Report of Trade and Commerce for fiscal year ended 31st March, 1912. (Part VII.—Trade of Foreign Countries, Treaties and Conventions). Presented, 1913. *Printed for distribution and sessional papers*

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13. Report of the Department of Inland Revenue for year ended 31st March, 1912. (Part II.—Inspection of Weights and Measures, Gas and Electricity). Presented by Hon. Mr. Nantel, 25th November, 1912.. .. ..*Printed for distribution and sessional papers.*

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39. "Miscellaneous Unforeseen Expenses," from the 1st April, to the 21st November, 1912, in accordance with the Appropriation Act of 1912. Presented by Hon. Mr. White, 25th November, 1912... .. ..*Not printed*

40. Statement of Treasury Board over-rulings, under Section 44, Consolidated Revenue and Audit Act. Presented by Hon. Mr. White, 26th November, 1912... .. ..*Not printed.*

41. Statement in pursuance of Section 17 of the Civil Service Insurance Act, for the year ending 31st March, 1912. Presented by Hon. Mr. White, 26th November, 1912.
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44. Statement of Superannuation and Retiring Allowances in the Civil Service during the year ending 31st December, 1912, showing name, rank, salary, service, allowance and cause of retirement of each person superannuated or retired, also whether vacancy is filled by promotion or by appointment, and salary of any new appointee. Presented by Hon. Mr. White, 26th November, 1912.. .. ..*Not printed*

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46. Return to an Order of the House of the 18th March, 1912, for a copy of all reports made by the Inspector of Agents for placing Immigrants, both domestic servants and farm labourers, in Ontario and Quebec, during the years 1910 and 1911. Presented 27th November, 1912, by Mr. Sutherland.. .. ..*Not printed.*

47. Return to an Order of the House of the 11th March, 1912, for a copy of all letters, telegrams and other papers in connection with complaints of whatever nature against Commission Agents for placing farm labourers in Ontario, also officials connected with any agency in Ontario, during the year 1910 and 1911. Presented 27th November, 1912 by Mr. Sutherland.. .. ..*Not printed*

48. Copy of Order in Council No. P. C. 1275, dated 13th May, 1912, "Award of compensation to men belonging to the Royal Canadian Navy, who may be permanently disabled though injuries or illness contracted during drill, training or on duty." Presented by Hon. Mr. Hazen, 27th November, 1912.. .. ..*Not printed.*

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48*b*. An Act respecting the Naval Service of Canada." (Copy of Order in Council, No. P. C. 126 dated 20th January, 1913, "Amendment to the Regulations for the Entry of Naval Cadets)." Presented by Hon. Mr. Hazen, 4th February, 1913.. ..*Not printed.*

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50. Statement of the affairs of the Royal Society of Canada, for the year ended 30th April, 1912. Presented by Hon. Mr. White, 29th November, 1912.. .. ..*Not printed.*

51. Ordinances of the Yukon Territory passed by the Yukon Council in the year 1912. Presented by Hon. Mr. Coderre, 3rd December, 1913.. .. ..*Not printed*

52. Return of Orders in Council which have been published in the *Canada Gazette*, between 1st August, 1911, and 30th September, 1912, in accordance with the provisions of Section 77 of the Dominion Lands Act, Chapter 20 of the Statutes of Canada, 1908. Presented by Hon. Mr. Roche, 5th December, 1912.. .. ..*Not printed.*

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52*b*. Return of Orders in Council which have been passed and published in the *Canada Gazette* and in the British Columbia *Gazette*, between 1st August, 1911, and 30th September, 1912, in accordance with provisions of Subsection (*d*) of Section 38 of the regulations for the survey, administration, disposal and management of Dominion Lands within the 40-mile Railway Belt in the Province of British Columbia. Presented by Hon. Mr. Roche, 5th December, 1912.. .. ..*Not printed*

52*c*. Return to an Order of the House of the 24th February, 1913, for a copy of all regulations issued by the Minister of the Interior, relating to the disposition of Dominion lands between 8th April, 1905, and 12th October, 1911. Presented by Hon. Mr. Roche. 25th March, 1913.. .. ..*Not printed.*

53. A detailed statement of all bonds or securities registered in the Department of the Secretary of State of Canada, since last return (28th November, 1911) submitted to the Parliament of Canada under Section 32 of Chapter 19, of the Revised Statutes of Canada. 1906. Presented by Hon. Mr. Coderre, 4th December, 1912.. .. ..*Not printed.*

54. Annual Return respecting Trade Unions under Chapter 125, R.S.C., 1906. Presented by Hon. Mr. Coderre, 4th December, 1912... .. ..*Not printed.*

55. Deliberation of the Canada-West Indies Conference, and Agreement between Canada and certain of the West India Colonies. Presented by Hon. Mr. Foster, 4th December, 1912.. .. ..*Printed for distribution and sessional papers*

56. Orders in Council passed between the 1st August, 1911, and 30th September, 1912, in accordance with the provisions of the Rocky Mountains Park Act, Chapter 60, Revised Statutes of Canada, 1906. Presented by Hon. Mr. Rogers, 4th December, 1912.
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56*a*. Return of Orders in Council passed between the 1st August, 1911, and 30th September, 1912, in accordance with the provisions of the Forest Reserves and Park Act, Section 19, of Chapter 10, 1-2 George V. Presented by Hon. Mr. Roche, 5th December, 1912.
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58. Report of the proceedings for the preceding year of the Commissioners of Internal Economy of the House of Commons, pursuant to Rule 9. Presented by Hon. The Speaker, 9th December, 1912.. .. ..*Not printed.*

59. Schedules of Trade Transactions between the West Indies and Canada, the United States and the United Kingdom, compiled from the West Indian blue books and statistics. Presented by Hon. Mr. Foster, 12th December, 1912.
Printed for distribution and sessional papers.

CONTENTS OF VOLUME 27—*Continued.*

59*a*. Trade Statistics of Imports and Exports in possession of the Government, re British West Indies. (*Senate*).. .. ..*Not printed.*

60. Return showing correspondence concerning the calling for tenders for the Ships of War of Canada, together with copies of tenders. Presented by Hon. Mr. Hazen, 12th December, 1912.. .. ..*Not printed.*

61. Return to an Order of the House of the 9th December, 1912, for a copy of all correspondence, telegrams, reports and documents relating to the dismissal of John R McDonald, Heatherton, Antigonish County, as Indian agent for the district including the Counties of Antigonish and Guysborough, and the appointment of his successor. Presented 4th January, 1913.—*Mr. Chisholm* (*Antigonish*).. .. ..*Not printed.*

61*a*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Dr. C. P. Bissett, Physician to the Indians at Salmon River, Richmond County, N.S. Presented 14th January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61*b*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Michael Murphy, postmaster at Point Micheau, Richmond County, N.S. Presented 4th January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61*c*. Return to an Order of the House of the 9th December, 1912, for copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of David A. McLeod, Postmaster at Cleveland, Richmond County, N.S. Presented 14th January.—*Mr. Kyte*.. .. ..*Not printed.*

61*d*. Return to an Order of the House of the 4th December, 1912, for a copy of all papers, letters, complaints, telegrams, reports, and other documents in the possession of the Post Office Department relating to the dismissal of John Milward, Postmaster at Stormont, Guysborough County, N.S. Presented 14th January, 1913.—*Mr. Sinclair.*
Not printed.

61*e*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents, relating to the dismissal of Kenneth F. McAskill, Postmaster at Loch Lomond, Richmond County, N.S. Presented 14th January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61*f*. Return to an Address to His Royal Highness the Governor General of the 25th March, 1912, for a copy of all letters, telegrams, memorandums and Orders in Council, relating to the dismissal of Mr. W. W. Hayden, late wharfinger of the government wharf at Digby, Nova Scotia. Presented 14th January, 1913.—*Mr. MacLean* (*Halifax*).
Not printed.

61*g*. Return to an Order of the House of the 11th December, 1912, for a copy of all complaints and charges made against W. B. Langley, assistant at Lobster Hatchery, Nova Scotia, and of all letters, telegrams and correspondence relating in any way to his dismissal and the appointment of a successor. Presented 14th January, 1913.—*Mr Sinclair*.. .. ..*Not printed.*

61*h*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Fred. E. Cox, engineer lobster hatchery at Isaac's Harbour, Guysborough County, N.S., and of the evidence taken and report of investigation held by H. P. Duchemin in regard to the same. Presented 14th January, 1913.—*Mr. Sinclair*.. .. ..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61*i*. Return to an Order of the House of the 11th December, 1912, for a copy of all complaints and charges made against Simon Hodgson, engineer lobster hatchery at Isaac's Harbour, Nova Scotia, and of all letters, telegrams and correspondence relating in any way to his dismissal and the appointment of a successor. Presented 14th January 1913.—*Mr. Sinclair*.. .. ..*Not printed.*

61*j*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Henry Henlow, chief engineer at lobster hatchery at Canso, Guysborough County, N.S. Presented 14th January, 1913.—*Mr. Sinclair*.. .. ..*Not printed.*

61*k*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of H. C. V. LeVatte, harbour master at Louisburg, Cape Breton South, N.S., and of evidence taken and report of investigations held by H. P. Duchemin, in regard to the same. Presented 14th January, 1913.—*Mr. Carroll*.. .. ..*Not printed.*

61*l*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of John Cummings, assistant at the lobster hatchery at Isaac's Harbour, Nova Scotia, and of evidence taken and reports of investigation held by H. P. Duchemin, in regard to the same. Presented 14th January, 1913.—*Mr. Sinclair*.. .. ..*Not printed.*

61*m*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of W. G. Matthews, coxswain, lifeboat crew at Canso, Guysborough County, N.S., and all evidence taken and report of investigation held by H. P. Duchemin in regard to the same; also a detailed statement of the expenses of such investigation. Presented 14th January, 1913.—*Mr. Sinclair*.. .. ..*Not printed.*

61*n*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams, and other documents relating to the dismissal of Joseph Shean, harbour master at North Sydney, N.S., in the riding of North Cape Breton and Victoria. Presented 14th January, 1913.—*Mr. McKenzie*.. .. ..*Not printed.*

61*o*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents, relating to the dismissal of George H. Sampson, keeper of the storm signal at Lower L'Ardoise, Richmond County, N.S. Presented 14th January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61*p*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Alexis Vigneau, captain of the patrol boat at Arichat, Richmond County, N.S. Presented 14th January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61*q*. Return to an Address to His Royal Highness the Governor General of the 4th December, 1912, for a copy of all correspondence, Orders in Council and all other papers or documents in any way relating to the dismissal of Emeri Thivierge, from the position of fisheries inspector for the Counties of Prescott and Russell. Presented 14th January, 1913.—*Mr. Murphy*.. .. ..*Not printed.*

61*r*. Return to an Order of the House of the 9th December, 1912, for a return showing all the public officers of the Inland Revenue Department in the County of St. Jean Iberville, removed by the present Government since 1st May, 1912, together with the names and duties of such persons, the reasons of their dismissal, the nature of the

CONTENTS OF VOLUME 27—*Continued.*

complaints against them, the names of the persons who brought these complaints; also a copy of all correspondence relating thereto, and of the reports of inquiries in the cases where such have been held. Presented 14th January, 1913.—*Mr. Demers.*

Not printed.

61*s*. Return to an Order of the House of the 4th December, 1912, for a copy of all correspondence, complaints, petitions, memoranda, notes of evidence, reports of investigations and other documents in the possession of the Department of Inland Revenue regarding the dismissal of J. Fabien Bugeaud, Bonaventure, Quebec, assistant inspector of weights and measures in the Quebec district, and the appointment of his successor or successors, with the names, residence, salaries and duties; also of all documents relating to A. B. Caldwell, New Carlisle, Quebec, joint assistant inspector with J. Fabien Bugeaud, and the duties assigned to him, together with a copy of all recommendations for said new appointment. Presented 14th January, 1913.—*Mr. Marcil (Bonaventure)*.. .. ..*Not printed.*

61*t*. Return to an Address to His Royal Highness the Governor General of the 4th December, 1912, for a copy of all correspondence, Orders in Council and all other papers or documents in any way relating to the dismissal of Duncan McArthur, from the Annuities Branch, while the said branch was attached to the Department of Trade and Commerce. Presented 15th January, 1913.—*Mr. Murphy*.. .. ..*Not printed.*

61*u*. Return to an Order of the House of the 26th February, 1912, for a copy of all documents, letters, requests, reports, recommendations and evidence taken under investigation by Dr. Shentliff, relating to the dismissal of Charles O. Jones, postmaster of Bedford, County of Missisquoi. Presented 15th January, 1913.—*Mr. Kay.*

Not printed.

61*v*. Return to an Order of the House of the 1st April, 1912, for a copy of all letters, telegrams, complaints or other papers or documents in the possession of the Government or any department thereof, relating to the dismissal of Archibald Barss, postmaster, New Harbour, West, Guysborough County, N.S. Presented 15th January, 1913.—*Mr. Sinclair*.. .. ..*Not printed.*

61*w*. Return to an Order of the House of the 10th December, 1912, for a copy of all correspondence, documents, recommendation and other reports respecting the dismissal of Dr. A. Allaire as surgeon of the penitentiary of St. Vincent de Paul, and also respecting the payments of his gratuities, superannuation or retiring allowance. Presented 15th January, 1913.—*Mr. Wilson (Laval)*.. .. ..*Not printed*

61*x*. Return to an Order of the House of the 10th December, 1912, for a copy of all correspondence, documents, recommendations and reports respecting the dismissal of Oscar Beauchamp as warden of the penitentiary of St. Vincent de Paul, and also respecting the payments of his gratuities, superannuation or retiring allowance. Presented 15th January, 1913.—*Mr. Wilson (Laval)*.. .. ..*Not printed.*

61*y*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of John McDonald, freight handler and checker Intercolonial railway at Sydney Mines Nova Scotia, in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to same, and a detailed statement of the expenses of such investigation. Presented 16th January, 1913.—*Mr. Mackenzie*.. .. ..*Not printed.*

61*z*. Return to an Order of the House of the 9th December, 1912, for a copy of all letters, correspondence, documents and reports relating to the dismissal of Allan Kinney, of Linwood, Antigonish County, Nova Scotia, a sectionman on the Intercolonial rail-

CONTENTS OF VOLUME 27—*Continued.*

way, and for a statement in detail of the expenses in connection with the investigation of the charges against him. Presented 16th January, 1913.—*Mr. Chisholm (Antigonish)*.. .. ..*Not printed.*

61*aa*. Return to an Order of the House of the 9th December, 1912, for a copy of all letters, correspondence, documents and reports relating to the dismissal of Charles Landry, of Pomket, Antigonish county, Nova Scotia, a sectionman on the Intercolonial railway, and for a statement in detail of the expenses connected with the investigation of the charges against him. Presented 16th January, 1913.—*Mr. Chisholm (Antigonish)*.. .. ..*Not printed.*

61*bb*. Return to an Order of the House of the 4th December, 1912, for a copy of all papers, documents, reports, correspondence, &c., relating to the dismissal of Patrick Decoste, an employee on the ferry steamer *Scotia* between Mulgrave and Point Tupper on the Intercolonial railway. Presented 16th January, 1913.. .. ..*Not printed.*

61*cc*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Harry E. McDonald, assistant engineer at St. Peters Canal, Richmond County, N.S Presented 13th January, 1913.—*Mr. Kyte.*

61*dd*. Return to an order of the House of the 9th December, 1912, for a copy of all letters, papers, documents, telegrams, and charges relating to a complaint against Neil Ross sectionman on the Intercolonial railway at West River, County of Pictou, and of the evidence taken at the investigation, of the report of the commissioner thereon, and of all letters, papers or other documents relating to the appointment of his successor. Presented 16th January, 1913.—*Mr. Macdonald*.. .. ..*Not printed.*

61*ee*. Return to an Order of the House of the 9th December, 1912, for a copy of all letters, correspondence, documents and reports relating to the dismissal of James Armstrong, of Heatherton, Antigonish County, N.S., a sectionman on the Intercolonial railway, and for a statement in detail of the expenses connected with the investigation of the charges against him. Presented 16th January, 1913.—*Mr. Chisholm (Antigonish).* *Not printed.*

61*ff*. Return to an Order of the House of the 4th December, 1912, for a copy of all letters, telegrams and other documents, relating to the dismissal of Thomas J. Gray, as car inspector on the Intercolonial railway at Westville, County of Pictou. Presented 16th January, 1913.—*Mr. Macdonald*.. .. ..*Not printed.*

61*gg*. Return to an Order of the House of the 9th December, 1912, for a copy of all correspondence, telegrams and reports relating to the dismissal of Colin Macdonald, of James River Station, County of Antigonish, as Intercolonial sectionman, and the appointment of his successor. Presented 16th January, 1913.—*Mr. Chisholm (Antigonish)*.. .. ..*Not printed.*

61*hh*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams, and other documents relative to the dismissal of A. T. Gaunon, car repairer and inspector Intercolonial railway at North Sydney, Nova Scotia, in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to same, and a detailed statement of the expenses of such investigation. Presented 16th January, 1913.—*Mr. McKenzie*.. .. ..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61*ii*. Return to an Order of the House of the 9th December, 1912, for a copy of all letters, correspondence, documents, and reports relating to the dismissal of Huber Myatte, Tracadie, Antigonish County, Nova Scotia, a sectionman on the Intercolouial railway and for a statement in detail of the expenses connected with the investigation of the charges against him. Presented 16th January, 1913.—*Mr. Chisholm* (*Antigonish*).
Not printed.

61*jj*. Return to an Order of the House of the 9th December, 1912, for a copy of all letters, correspondeuce, documeuts, and reports relating to the dismissal of John McDonnell, Afton Station, Antigonish County, Nova Scotia, a sectionman on the Intercolonial railway, and for a statement in detail of the expenses connected with the investigation of the charges againsi him. Presented 17th January, 1913.—*Mr. Chisholm* (*Antigonish*).. .. ..*Not printed.*

61*kk*. Return to an Order of the House of the 9th December, 1911, for a copy of all letters, correspondence, documents aud reports relatiug to the dismissal of William Landry, of Pomket, Antigonish County, Nova Scotia, a section foreman of the Intercolonial railway, and for a statement in detail of the expenses connected with the investigation of the charges againt him. Presented 17th Jauuary, 1913.—*Mr. Chisholm* (*Antigonish*).. .. ..*Not printed.*

61*ll*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, telegrams and other documents relative to the dismissal of D. J. McDougall, section foreman, Intercolonial railway, Grand Narrows, Nova Scotia, in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to same, and a detailed statement of the expenses of such investigation. Presented 17th January, 1913.—*Mr. McKenzie.*
Not printed.

61*mm*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Dan. A. Coffey, lockman at St. Peter's canal, Richmond County, N.S., and of the evidence taken aud of the reports of investigation held by H. P. Duchemin, in regard to the same, and a detailed statement of the expenses of such investigation; and a copy of all papers relating to the appointment of his successor. Also, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of W. A. McNeil, lockman at St. Peter's canal, Richmond County, N.S., and of the evidence taken and of the report of investigation held by H. P. Duchemin in regard to the same, and a detailed statement of the expenses of such investigation; and a copy of all papers relating to the appointment of his successor. Presented 17th January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61*nn*. Return to au Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of John P. Meagher, foreman deckhand on steamship *Scotia*, Mulgrave, Guysborough County, N.S., and of all evidence taken and reports of investigation held by H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of such investigation. Presented 17th Jauuary, 1913.—*Mr. Sinclair*.. .. .. ..*Not printed.*

61*oo*. Return to an Order of the House of the 4th December, 1912, for a copy of all letters, telegrams, evidence taken, reports, &c., and of all correspondence between the Postmaster General and officers of his department, and James Gibson, ex-postmaster of Alameda, Sask., in connection with the instructions sent him to hand the office over to E. Cronk. Presented 17th January, 1913.—*Mr. Turriff*.. .. ..*Not printed.*

61*pp*. Return to an Order of the House of the 11th December, 1912, for a copy of all papers, documents and correspondence relating to the dismissal of Captain C. E. Miller from the 75th Regiment. Presented 17th January, 1913.—*Mr. Maclean* (*Halifax*).
Not printed.

CONTENTS OF VOLUME 27—*Continued.*

61*qq*. Return to an Order of the House of the 9th December, 1912, for a copy of all correspondence, letters and telegrams relating to the dismissal of J. N. N. Poirier, collector of excise at Victoriaville, Quebec, and also of the inquiry made by N. Garceau, by the Minister of Inland Revenue, and especially of two affidavits given by Ludger Frechette and Joseph Faucher. Presented 17th January, 1913.—*Mr. Brouillard.* *Not printed.*

61*rr*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams, and other documents relative to the dismissal of Abraham Astephen, of North Sydney, N.S., interpreter Immigration Department at North Sydney, N.S., in the riding of North Cape Breton and Victoria. Presented 17th January, 1913.—*Mr. McKenzie*.. .. ..*Not printed.*

61*ss*. Return to an Address to His Royal Highness the Governor General of the 4th December, 1912, for a copy of all correspondence, Orders in Council, and all other papers or documents in any way relating to the dismissal of Robert Dow from the Immigration Branch of the Department of the Interior at Ottawa. Presented 17th January, 1913. —*Mr. Murphy*.. .. ..*Not printed.*

61*tt*. Return to an Order of the House of the 9th December, 1912, for a copy of all papers, documents, correspondence, &c., relating to the dismissal of John Ware of the Immigration Branch of the Interior Department at Halifax, N.S. Presented 17th January, 1913.—*Mr. Maclean (Halifax)*.. .. ..*Not printed.*

61*uu*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges correspondence, letters, telegrams, and other documents relative to the dismissal of Richard Hickey, agent Immigration Department at North Sydney, Nova Scotia, in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to the same, and a detailed statement of the expenses of such investigation. Presented 17th January, 1913.—*Mr. McKenzie*.. .. ..*Not printed.*

61*vv*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges correspondence, letters, telegrams, and other documents relative to the dismissal of Dr. J. W. McLean, of North Sydney, N.S., medical examiner, Immigration Department at North Sydney, N.S., in the riding of North Cape Breton and Victoria. Presented 17th January, 1913.—*Mr. McKenzie*.. .. ..*Not printed.*

61*ww*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of John A. McRea, lightkeeper, at Margaree Island, Inverness County, Nova Scotia, of the evidence taken and report of investigation held by H. P. Duchemin in regard to the same; also a detailed statement of the expenses of such investigation. Presented 17th January, 1913.—*Mr. Chisholm (Inverness)*.. .. .. ..*Not printed.*

61*xx*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Thomas Brymer, lightkeeper at Lower L'Ardoise, Richmond County, N.S. Presented 17th January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61*yy*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges correspondence, letters, telegrams and other documents relating to the dismissal of Dominique Boudrot, buoy contractor, at Petit de Grat, Richmond County, N.S. Presented 17th January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61*zz*. Return to an Order of the House of the 4th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents concerning the dismissal of Frederick F. Doucet, keeper of the lighthouse at the entrance of the harbour of Caraquet, County of Gloucester, and the nomination of his successsor. Presented 17th January, 1913.—*Mr. Turgeon*.. .. ..*Not printed.*

61*aaa*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documeuts relating to the dismissal of W. H. Henlow, keeper of storm drum, Liscomb, Guysborough County, N.S. Presented 17th January, 1913.—*Mr. Sinclair*.. .. ..*Not printed.*

61*bbb*. Return to an Order of the House of the 4th Decemher, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of David Falconer, lightkeeper at Cariboo Island, County of Pictou. Presented 17th January, 1913.—*Mr. Macdonald*.. .. ..*Not printed.*

61*bbb*. Return to an Order of the House of the 4th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of M. Wilson Lawlor, harbour commissioner at North Sydney, Nova Scotia, in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to same, and a detailed statement of the expenses of such investigation. Presented 17th January, 1913.—*Mr. McKenzie.*

Not printed.

61*ddd*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of P. J. McDonald, harbour commissioner at North Sydney, Nova Scotia, in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to same, and a detailed statement of the expenses of such investigation. Presented 17th January, 1913.—*Mr. McKenzie.*

Not printed.

61*eee*. Return to an Order of the House of the 9th December, 1912, for a return showing: 1. The names of all lightkeepers in the Province of Nova Scotia who were dismissed from office or employment since 10th October, 1911, together with the date of each dismissal. Presented 17th January, 1913.—*Mr. Maclean (Halifax)*.. .. ..*Not printed.*

61*fff*. Return to an Order of the House of the 4th December, 1912, for a return showing the detail aud number of dismissals from public offices in the Department of Marine and Fisheries to this date in the County of Bonaventure, the names of the dismissed occupants, the reasons for their dismissal, the complaints against such officials and a copy of all correspondence with respect to tho same, aud of all reports of investigations where such were held; as well as a list of the new appointments made by the department, with names, residences, salaries and duties,and a copy of all recommendations of such appointments. Presented 17th January, 1913.—*Mr. Marçil (Bonaventure)*.

Not printed.

61*ggg*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of H. L. Tory, fishery officer at Guysborough, Guysborough County, N.S., and of all evidence taken, and report of investigation held by H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of the investigation. Presented 17th January, 1913.—*Mr. Sinclair*.. .. ..*Not printed.*

61*hhh*. Return to an Order of the House of the 4th December, 1912, for a copy of all charges, correspondence, letters, telegrams, and other documents in the possession of the Department of Marine and Fisheries relating to the dismissal of John W. Davis, fishery officer, Guysborough, N.S. Presented 17th January, 1913.—*Mr. Sinclair.*

Not printed.

CONTENTS OF VOLUME 27—*Continued.*

61*jjj*. Return to an Order of the House of the 4th December, 1912, for a copy of all charges correspondence, letters, telegrams and other documents relating to the dismissal of Martin Bourque, lightkeeper at River Bourgeois, Richmond County, N.S., and of the evidence taken and of the report of the investigation held by H. P. Duchemin in regard to the same, and a detailed statement of the expenses of such investigation; and a copy of all papers relating to the appointment of his successor. Presented 17th January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61*jjj*. Return to an Order of the House of the 4th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Frederick Poirier, buoy contractor, at Descouse, Richmond County, N.S. Presented 17th January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61*kkk*. Return to an Order of the House of the 4th December, 1912, for a copy of all papers, letters, telegrams and petitions for and against the dismissal of Dr. George Pinault, as medical health officer of the Mic-Mac Indian reserve, at Ste. Anne de Restigouche, Bonaventure County, Quebec, and of all documents relating to the appointment of a successor, with the name, residence, salary and duties of the new appointee. Presented 20th January, 1913.—*Mr. Marcil*.. .. ..*Not printed.*

61*lll*. Return to an Order of the House of the 1st April, 1912, for a copy of all papers, letters, &c., concerning the dismissal of Frederick Veit, employed by the Department of Marine and Fisheries in the County of Gaspé. Presented 20th January, 1913.—*Mr. Lemieux*.. .. ..*Not printed.*

61*mmm*. Return to an Order of the House of the 1st April, 1912, for a copy of all letters, petitions, complaints, declarations and other documents in the possession of the Department of Marine and Fisheries, relating to the dismissal of Mr. Alfred Laloude, employed in the warehouse of the Government yards at St. Joseph de Sorel and the appointment of his successor. Presented 20th January, 1913.—*Mr. Cardin*..*Not printed.*

61*nnn*. Return to an Order of the House of the 1st April, 1912, for a copy of all letters telegrams, complaints or other papers or documents in the possession of the Government or any department thereof, relating to the dismissal of James Webber, lightkeeper, Tor Bay Point, N.S. Presented 20th January, 1913.—*Mr. Sinclair.*

Not printed.

61*ooo*. Return to an Order of the House of the 1st April, 1912, for a copy of all documents letters, inquiries, reports, evidence, &c., relating to the dismissal or the resignation of Baptiste Desjardins as lighthouse keeper at Kamouraska. Presented 20th January, 1913.—*Mr. Lapointe (Kamouraska)*.. .. ..*Not printed.*

61*ppp*. Return to an Order of the House of the 4th December, 1912, for a copy of all correspondence, letters, telegrams and other documents relating to the dismissal of Angus Smith, pilot on the steamer *Earl Grey*, and also of all the evidence taken at the latest investigation held in regard to the said complaints, and of the report of the investigation with regard to the same. Presented 20th January, 1913—*Mr. Macdonald.*

Not printed.

61*qqq*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Michael J. Sampson, lightkeeper at Lower L'Ardoise, Richmond County, N.S. Presented 20th January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61*rrr*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of William Hackett, harbour commissioner at North Sydney, Nova Scotia, in the riding

CONTENTS OF VOLUME 27—*Continued.*

of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin in regard to same, and a detailed statement of the expenses of such investigation. Presented 20th January, 1913.—*Mr. McKenzie.*

Not printed.

61*sss*. Return to an Order of the House of the 9th December, 1912, for a copy of all correspondence and other documents in the possession of the Department of Marine and Fisheries relating to the dismissal of Hormidas Lacasse, as wharfinger on the government wharf at Wendover, County of Prescott, Ontario, and the appointment of his successor. Presented 20th January, 1913.—*Mr. Proulx*.. .. ..*Not printed.*

61*ttt*. Return to an Order of the House of the 9th December, 1912, for a copy of all documents, papers, evidence and correspondence, relating to the dismissal of Geoffrey Gorman, coxswain of the lifeboat station at Herring Cove, Halifax County, N.S. Presented 20th January, 1913.—*Mr. Maclean (Halifax)*.. .. .. *Not printed.*

61*uuu*. Return to an Order of the House of the 10th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Captain George Wetmore, harbour master at Yarmouth, Yarmouth County, N.S., and the same information regardiug the appointment of Captain Wetmore's successor, and of all evidence taken and report of investigation held by Charles Lane in regard to the same, also a detailed statement of expenses of such investigation. Presented 20th January, 1913.—*Mr. Law*.. .. ..*Not printed.*

61*vvv*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams aud other documents relating to the dismissal of Stanley Henlow, lightkeeper at Liscomb, Guysborough County, N.S., and of evidence taken and report of investigation held by H. P. Duchemin in regard to the same; also a detailed statement of the expenses of such investigation. Presented 20th January, 1913.—*Mr. Sinclair*.. .. ..*Not printed.*

61*www*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of H. C. V. LeVatte, fishery officer at Louisburg, Cape Breton South, N.S., and of the evidence taken and reports of investigations held by H. P. Duchemin, in regard to the same. Presented 20th January, 1913.—*Mr. Carroll*.. .. ..*Not printed.*

61*xxx*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Elias M. Boudrot, keeper of storm signal at Petit de Grat, Richmond County N.S., and of the evidence taken and report of investigation held by H. P. Duchemin in regard to the same and a detailed statement of the expenses of such investigation; and a copy of all papers relating to the appointment of his successor. Presented 20th January, 1913.—*Mr Kyte*.. .. ..*Not printed.*

61*yyy*. Return to an Order of the House of the 10th December, 1912, for a return of all charges, correspondence, letters, telegrams aud other documents relating to the dismissal of A. B. Cox, Superintendent of Reduction Works at Canso, Guysborough County, N.S., and of all evidence taken and report of investigation held by H. P Duchemin in regard to the same; also a detailed statement of the expenses of such investigation. Presented 20th January, 1913. *Mr. Kyte*.. .. ..*Not printed.*

61*zzz*. Return to an Order of the House of the 9th December, 1912, for a copy of all complaints and charges made against Jeffrey Crespo, sub-collector of Customs at Harbour au Bouche, Antigonish County, Nova Scotia, and of all letters, telegrams, correspondence and reports relating in any way to his dismissal and the appointment of a successor. Presented 20th January, 1913.—*Mr. Chisholm (Antigonish)*.

Not printed.

CONTENTS OF VOLUME 27—*Continued.*

61*aaaa*. Return to an Order of the House of the 9th December, 1912, for a copy of all letters, papers, charges and correspondence between the Department of Customs and all other persons regarding the dismissal from office of Thomas Cameron, preventive officer at Andover, N.B., and also of all evidence and reports thereon with reference to the dismissal of the said officer. Presented 20th January, 1913.—*Mr. Michaud.*

Not printed.

61*bbbb*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of L. W. Pye, customs officer at Liscomb, Guysborough County, N.S., and of all evidence taken and reports of investigation held by H. P. Duchemin in regard to the same; also a detailed statemeut of the expenses of such iuvestigation. Presented 20th January, 1913.—*Mr. Sinclair*.. .. ..*Not printed.*

61*cccc*. Return to an Order of the House of the 9th December, 1912, for a copy of all complaints, accusations, inquiries, reports, correspondence, and of all documents relating to the dismissal of Lucien O. Thisdale, a customs employee at Valleyfield, Quebec, and the appointment of his successor. Preseuted 20th January, 1913.—*Mr. Papineau.*

Not printed.

61*dddd*. Return to an Order of the House of the 11th December, 1912, for a copy of all letters, telegrams, correspondence, reports, and other documents relating to the dismissal of Alexander Macdonald of Doctor's Brook, Antigonish County, as sub-collector of customs. Presented 20th January, 1913.—*Mr. Chisholm (Antigonish).*

Not printed.

61*eeee*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondeuce, letters, telegrams, and other documeuts relative to the dismissal of Henry Cann, customs official and preventive officer at North Sydney, Nova Scotia, in the riding of North Cape Breton aud Victoria. Presented 20th Januuary, 1913.—*Mr. McKenzie*.. .. ..*Not printed*

61*ffff*. Return to an Order of the House of the 10th December, 1912, for a copy of all documents concerning the dismissal of Charles Mennier, customs preveutive officer at Marieville, Quebec. Presented 20th January, 1913.—*Mr. Lemieux*.. .. ..*Not printed.*

61*gggg*. Return to an Order of the House of the 5th December, 1912, for a copy of all charges, correspondence, letters, telegrams, instructions, minutes of evidence takeu and had on any inquiry iuvestigation had, held or taken, and of all other papers and documents relating to the dismissal of George H. Cochrane, Collector of Customs at the Port of Moncton, New Brunswick; together with a copy of all letters and other correspondence between the Honourable Minister of Customs, and the member representing the County of Westmorland, New Brunswick, in this House, and of all letters, papers, telegrams, recommendations, appointments, or other papers and documents relating to the appointment of a collector of customs to succeed the said George H. Cochrane. Presented 20th January, 1913.—*Mr Emmerson*.. .. ..*Not printed.*

61*hhhh*. Return to an Order of the House of the 22nd January, 1912, for a copy of all correspondence, documents, recommendations and reports respecting the dismissal of C Michaud, postmaster at St. Germain, Kamouraska, and the appointment of his successor. Presented 20th January, 1913.—*Mr. Lapointe (Kamouraska)*.. ..*Not printed.*

61*iiii*. Return to an Order of the House of the 25th March, 1912, for a copy of all letters, telegrams and other documents, and of all complaints or accusations relating in any manner to the dismissal of Mr. Emile Archambault, letter carrier of Montreal, and a copy of the inquiry, and of the report of the inquiry held. Presented 20th January, 1913.—*Mr. Seguin*.. .. ..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61*jjjj*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Norman Morrison, postmaster at Ferguson's Lake, Richmond County, N.S. Presented 21st January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61*kkkk*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of D. J. McKillop, postmaster at McKillop, Richmond County, N.S. Presented 21st January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61*llll*. Return to an Order of the House of the 22nd January, 1912, for a copy of all correspondence, papers and reports in connection with the investigation recently held at the Ste. Agathe post office, County of Terrebonne. Presented 21st January. 1913.—*Mr. Lemieux*.. .. ..*Not printed.*

61*mmmm*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Bertie Boudrot, lightkeeper at Poulamon, Richmond County, N.S., and of the evidence taken and reports of investigation held by H. P. Duchemin in regard to the same, and a detailed statement of the expenses of such investigation, and a copy of all papers relating to the appointment of his successor. Presented 22nd January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61*nnnn*. Return to an Order of the House of the 1st April, 1912, for a copy of all letters, telegrams and other documents and of all complaints, accusations and requests for inquiry, relating in any manner to the lighthouse keepers of Repentigny, P.Q., Messrs. Leon Rivest, J. B. Lachapelle and Louis Dubois, since 21st September last; also a copy of the inquiry and the report of the inquiry held in the matter. Presented 22nd January, 1913.—*Mr. Seguin*.. .. ..*Not printed.*

61*oooo*. Return to an Order of the House of the 9th December, 1912, for a copy of all papers, documents, telegrams, letters, &c., relating to the dismissal of L. P. Carignan, forest ranger in the constituency of Champlain, Quebec. Presented 24th January, 1913.—*Mr. Maclean (Halifax)*.. .. ..*Not printed.*

61*pppp*. Return to an Order of the House of the 5th December, 1912, for a copy of all correspondence, complaints, petitions, memoranda, notes of evidence, letters, reports of investigations and other documents in the possession of the Department of Customs, relating to the dismissal of James S. Harvey, preventive officer, New Richmond, Quebec; W. L. Kempffer, preventive officer at Paspebiac, Quebec; J. Herbert Sweetman, preventive officer at Port Daniel, Quebec; J. B Le Blanc, preventive officer, at Carleton, Quebec; J. Nadeau, preventive officer, Nouvelle, Quebec, as well as a copy of all recommendations made regarding the appointment of their various successors and the names, salaries, duties and residences, with a copy of their instructions. Presented 24th January, 1913.—*Mr. Marcil*.. .. ..*Not printed.*

61*qqqq*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams, and other documents relative to the dismissal of William Marsh, preventive officer at Little Pond, Sydney Mines, in the riding of North Cape Breton and Victoria. Presented 24th January, 1913.—*Mr. McKenzie*. *Not printed.*

61*rrrr*. Return to an Order of the House of the 9th December, 1912, for a copy of all papers, letters, telegrams, and petitions, for and against the dismissal of Duncan McDonald, preventive officer of customs at Athelstan, County of Huntingdon; also a copy of the report of investigation and evidence submitted to investigating commissioner. Presented 24th January, 1913.—*Mr. Robb*.. .. ..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61*ssss*. Return to an Address to His Royal Highness the Governor General of the 11th December, 1912, for a copy of all papers, documents, orders in council, telegrams, letters, &c., relating to the dismissal from office of Lemuel Bent, late Collector of Customs at Oxford, N.S. Presented 24th January 1913.—*Mr. Maclean (Halifax).*
Not printed.

61*tttt*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Pascal Poirier, Collector of Customs at Descouse, Richmond County, N.S., and of the evidence taken and reports of investigation held by H. P. Duchemin in regard to the same and a detailed statement of the expenses of such investigation; and a copy of all papers relating to the appointment of his successor. Presented 24th January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61*uuuu*. Return to an Order of the House of the 4th December, 1912, for a copy of all correspondence, letters, telegrams, reports and other documents concerning the dismissal of Donald J. Hachey, Collector of Customs at Bathurst, County of Gloucester, and the appointment of his successor. Presented 24th January, 1913.—*Mr. Turgeon.*
Not printed.

61*vvvv*. Return to an Address to His Royal Highness the Governor General of the 4th December, 1912, for a copy of all correspondence, orders in council, and all other papers or documents in any way relating to the dismissal of John Maher, from the service of the Customs Department at Montreal. Presented 24th January, 1913.—*Mr. Murphy*.. .. ..*Not printed.*

61*wwww*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Peter Fougère, preventive and customs officer at Petit de Grat, Richmond county, N.S., and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to the same, and a detailed statement of the expenses of such investigation; and a copy of all papers relating to the appointment of his successor. Presented 24th January, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61*xxxx*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of James Grantmyre, preventive officer at Little Bras D'or, N.S., in the riding of North Cape Breton and Victoria. Presented 24th January, 1913.—*Mr. McKenzie.*
Not printed.

61*yyyy*. Return to an Order of the House of the 15th January, 1913, for a return showing all the employees on the Soulanges Canal who have been dismissed from their duties since the 21st September, 1911, by whom each of these employees has been replaced, and for what causes were they dismissed. Presented 27th January,1913.—*Mr. Beyer*.. .. ..*Not printed.*

61*zzzz*. Return to an Order of the House of the 15th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Andrew Melville, locktender at Cardinal, Ontario. Presented 27th January, 1913.—*Mr. Proulx*.. .. ..*Not printed.*

61*aaaaa*. Return to an Order of the House of 15th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of George Short, canal bridgetender at Cardinal, Ontario. Presented 27th January, 1913.—*Mr. Guthrie*.. .. ..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61*bbbbb*. Return to an Order of the House of the 15th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of N. Broderick, locktender at Cardinal, Ontario. Presented 27th January, 1913.—*Mr. McMillan*.. .. ..*Not printed.*

61*ccccc*. Return to an Order of the House of the 15th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Thomas McLatchie, locktender at Cardinal, Ontario. Presented 27th January, 1913.—*Mr. Graham*.. .. ..*Not printed.*

61*ddddd*. Return to an Order of the House of the 15th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Elgin McLaughlin, locktender at Cardinal, Ontario. Presented 27th January, 1913.—*Mr. Emmerson*.. .. ..*Not printed.*

61*eeeee*. Return to an Order of the House of the 15th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Robert Robertson, locktender at Cardinal, Ontario. Presented 27th January, 1913.—*Mr. Lemieux*.. .. ..*Not printed.*

61*fffff*. Return to an Order of the House of the 15th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of William L. Gladstone, locktender at Cardinal, Ontario. Presented 27th January, 1913.—*Mr. Pugsley*.. .. ..*Not printed.*

61*ggggg*. Return to an Order of the House of the 15th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Byron VanCamp, locktender at Cardinal, Ontario. Presented 7th January, 1913.—*Mr. Murphy*.. .. ..*Not printed.*

61*hhhhh*. Return to an Order of the House of the 15th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Samuel English, canal bridge tender at Cardinal, Ontario. Presented 27th January, 1913.—*Mr. Carvell*.. .. ..*Not printed.*

61*iiiii*. Return to an Order of the House of the 15th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Edward F. Moran, locktender at Cardinal, Ontario. Presented 27th January, 1913.—*Mr. Oliver*.. .. ..*Not printed.*

67*jjjjj*. Return to an Order of the House of the 9th December, 1912, for a copy of all letters correspondence, documents and reports relating to the dismissal of William R. Fougere, of Frankville, Antigonish County, N.S., a sectionman on the Intercolonial rail way, and for a statement in detail of the expenses connected with the investigations of the charges against him. Presented 27th January, 1913.—*Mr. Chisholm (Antigonish)*. *Not printed.*

61*kkkkk*. Return to an Order of the House of the 9th December, 1912, for a copy of all letters, correspondence, documents and reports relating to the dismissal of John Melanson, of Afton, Antigonish County, N.S., a sectionman on the Intercolonial railway, and for a statement in detail of the expenses connected with the investigation of the charges against him. Presented 27th January, 1913.—*Mr. Chisholm (Antigonish)*. *Not printed.*

61*lllll*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Ronald D. McDonald, fishery overseer, at Broad Cove, Inverness County, Nova Scotia, and of the evidence taken and report of investigation held by H. P. Duchemin in regard to the same; also a detailed statement of the expenses of such investigation. Presented 27th January, 1913.—*Mr. Chisholm (Inverness)*. *Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61*mmmmm*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of John McLean, fishery officer at Gabarouse, Cape Breton South, N.S., and of evidence taken and reports of investigations held by H. P. Duchemin, in regard to the same. Presented 27th January, 1913.—*Mr. Carroll*.. .. ..*Not printed.*

61*nnnnn*. Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of A. R. Forbes, fishery overseer at North Sydney, Nova Scotia in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to same, and a detailed statement of the expenses of such investigation. Presented 27th January, 1913.—*Mr. McKenzie.*
Not printed.

61*ooooo*. Return to an Order of the House of the 15th January, 1913, for a copy of all correspondence, letters, telegrams, complaints, petitions, and other documents concerning the dismissal of Sebastien Savoie, superintendent of the lobster hatchery at Shippigan, Gloucester County, N.B., and the appointment of his successor. Presented 27th January, 1913.—*Mr. Turgeon*.. .. ..*Not printed.*

61*ppppp*. Return to an Order of the House of the 9th Decemher, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of D. S. Hendshee, weigher, reduction works, Canso, Guyshorough County N.S., and of all evidence taken and report of investigation held by H. P. Duchemin in regard to the same; also a detailed statement of the expenses of such investigation. Presented 27th January, 1913.—*Mr. Sinclair*.. .. ..*Not printed.*

61*qqqqq*. Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of M. Muce, lightkeeper at Cheticamp Island, Inverness County, Nova Scotia, and of the evidence taken and report of investigation held by H. P. Duchemin in regard to the same; also a detailed statement of the expenses of such investigation. Presented 29th January, 1913.—*Mr. Chisholm (Inverness)*.. .. .. ..*Not printed.*

61*rrrrr*. Return to an Order of the House of the 15th January, 1913, for a copy of all papers, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Dr. J. D. R. Williams, collector of canal tolls at Cardinal, Ontario, and of the appointment of his successor. Presented 30th January, 1913.—*Mr. McMillan*.. .. ..*Not printed.*

61*sssss*. Return to an Order of the House of the 15th January, 1913, for a copy of all papers, letters, telegrams, evidence and other documents regarding the dismissal of John W. Bohan, preventive officer at Bath, Carleton County, N.B. Presented 3rd February, 1913.—*Mr. Carvell*.. .. ..*Not printed.*

61*ttttt*. Return to an Order of the House of the 15th January, 1913, for a copy of all papers, documents, correspondence, &c., relating to the dismissal of J. V. Smith, sub-collector of customs at Wood's Harbour, Shelburne County, N.S. Presented 3rd February, 1913.—*Mr. Law*.. .. ..*Not printed.*

61*uuuuu*. Return to an Order of the House of the 15th January, 1913, for a copy of all papers, letters, telegrams, evidence and other documents regarding the dismissal of John Y. Fleming, customs officer at Debec, Carleton County, N.B. Presented 3rd February, 1913.—*Mr. Carvell*.. .. ..*Not printed.*

61*vvvvv*. Return to an Order of the House of the 15th January, 1913, for a copy of all papers, letters, telegrams, evidence and other documents regarding the dismissal of Matthias Meagher, preventive officer at Debec, Carleton County, N.B. Presented 3rd February, 1913.—*Mr. Carvell*.. .. ..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61*wwwww*. Return to an Order of the House of the 9th December, 1912, for a copy of all correspondence, letters, telegrams, complaints, and of the evidence given at investigation, if one was held, relating to the dismissal of Mr. A. J. Gosselin, acting preventive officer of customs at St. Albans, Vermont, through the port of St. Armand, County of Missisquoi. Presented 4th February, 1913.—*Mr. Kay*.. .. ..*Not printed.*

61*xxxxx*. Return to an Order of the House of the 4th December, 1912, for a copy of all papers, letters, telegrams, and petitions for and against the dismissal of James W. Bannon, preventive officer of customs at St. Agnes de Dundee, County of Huntingdon also a copy of the report of investigation and evidence, if any, submitted to investigating commissioner. Presented 4th February, 1913.—*Mr. Robb*.. .. ..*Not printed.*

61*yyyyy*. Return to an Order of the House of the 4th December, 1912, for a return showing the number of postmasters that have been dismissed in the County of Pictou since 1st October, 1911; the names of the postmasters who have been appointed to succeed them; the causes of the dismissals and all complaints and correspondence with respect to same, and of all reports of investigation where investigations have been held. Presented 4th February, 1913.—*Mr. Macdonald*.. .. ..*Not printed.*

61*zzzzz*. Return to an Address to His Royal Highness the Governor General of the 4th December, 1912, for a copy of all correspondence, orders in council, and all other papers or documents in any way relating to the dismissal of James Murphy from the position of postmaster at Tweed, Ontario. Presented 4th February, 1913.—*Mr. Murphy*.. .. ..*Not printed.*

61 (6*a*). Return to an Order of the House of the 15th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of H. B. Easton, immigration agent at Prescott, Ontario. Presented 4th February, 1913.—*Mr. Murphy*.. .. ..*Not printed.*

61 (6*b*). Return to an Order of the House of the 15th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of B. Hughes, immigration agent at Prescott, Ontario. Presented 4th February, 1913.—*Mr. Oliver*.. .. ..*Not printed.*

61 (6*c*). Return to an Order of the House of the 15th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of George Walsh, immigration agent at Prescott, Ontario. Presented 4th February, 1913.—*Mr. Oliver*.. .. ..*Not printed.*

61 (6*d*). Return to an Order of the House of the 15th January, 1913, for a copy of all papers, letters, telegrams, evidence and other documents regarding the dismissal of Newton S. Dow, immigration agent at McAdam Junction, York County, N.B. Presented 4th February, 1913.—*Mr. Carvell*.. .. ..*Not printed.*

61 (6*e*). Return to an Order of the House of the 15th January, 1913, for a copy of all papers, letters, telegrams, evidence and other documents regarding the dismissal of Oliver Hemphill, immigration agent at Debec, Carleton County, N.B. Presented 4th February, 1913.—*Mr. Carvell*.. .. ..*Not printed.*

61 (6*f*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Martin Johnston, preventive officer at Rea Islands, Richmond County, N.S Presented 6th February, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (6*g*). Return to an Order of the House of the 10th December, 1912, for a copy of all correspondence, letters, telegrams and other documents respecting the dismissal of J. E. Phaneuf, postmaster of St. Hugues, County of Bagot. Presented 6th February, 1913.—*Mr. Marcile*.. .. ..*Not printed*

61 (6*h*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Murdock McCutcheon, postmaster at Sonora, Guysborough County, N.S., and of all evidence taken and report of investigation held by Mr. H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of such investigation. Presented 6th February, 1913.—*Mr. Sinclair*.. .. ..*Not printed*

61 (6*i*). Return to an Order of the House of the 15th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of Duncan Gillies, fishery overseer at Baddeck, C.B., in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to same, and a detailed statement of the expenses of such investigation. Presented 7th February, 1913.—*Mr. McKenzie*.. .. ..*Not printed.*

61 (6*j*). Return to an Order of the House of the 9th December, 1912, for a copy of all complaints, accusations, correspondence, petitions and of all documents and reports respecting the dismissal of Antonio Ledue, postmaster of St. Timothée, in the County of Beauharnois and the appointment of his successor. Presented 7th February, 1913.—*Mr. Papineau*.. .. ..*Not printed.*

61 (6*k*). Return to an Address to His Royal Highness the Governor General of the 4th December, 1912, for a copy of the recommendation to council, the order in council, all correspondence with the government or any member thereof, and of all letters, documents and papers in any way connected with the dismissal of Charles Arthur Bowman from the engineering branch of the Department of Railways and Canals.—*Mr. Clark (Red Deer)*.. .. ..*Not printed.*

61 (6*l*). Return to an Order of the House of the 29th January, 1913, for a copy of all papers, documents, evidence, reports, letters, correspondence, &c., relating to the dismissal of Elnathan D. Smith, fishery overseer, Shag Harbour, Shelburne County, N.S. Presented 11th February, 1913.—*Mr. Law*.. .. ..*Not printed.*

61 (6*m*). Return to an Order of the House of the 15th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of Donald McAulay, lightkeeper, Plaister, Baddeck Bay, C.B., riding of North Cape Breton and Victoria, and of the evidence taken and reports of investigation held by H. P. Duchemin in regard to the same, and a detailed statement of the expenses of such investigation. Presented 11th February, 1913.—*Mr. McKenzie.* *Not printed.*

61 (6*n*). Return to an Order of the House of the 29th January, 1913, for a copy of all papers, documents, letters, correspondence, &c., relating to the dismissal of John Fredericks, lightkeeper at East Jordan, Shelburne County, N.S. Presented 11th February, 1913.—*Mr. Law*.. .. ..*Not printed.*

61 (6*o*). Return to an Order of the House of the 29th January, 1913, for a copy of all papers, documents, letters, correspondence, &c., relating to the dismissal of John Fredericks, wharfinger at East Jordan, Shelburne County, N.S. Presented 11th February, 1913.—*Mr. Law*.. .. ..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (6*p*). Return to an Order of the House of the 29th January, 1913, for a copy of all papers, documents, letters, correspondence, &c., relating to the dismissal of John C Morrison, harbour master at Shelburne, N.S. Presented 11th February, 1913.—*Mr. Maclean (Halifax)*.. .. ..*Not printed.*

61 (6*q*). Return to an Order of the House of the 15th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of Captain Roderick McDonald, tide waiter, at Big Bras D'Or, riding of North Cape Breton and Victoria, N.S., and of the evidence taken and reports of investigation held by H. P. Duchemin in regard to the same, and a detailed statement of the expenses of such investigation. Presented 11th February, 1913.—*Mr. McKenzie.*
Not printed.

61 (6*r*). Return to an Order of the House of the 15th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of James Maloney, customs officer at Dingwall, riding of North Cape Breton and Victoria, N.S., and of the evidence taken and reports of investigation held by H. P. Duchemin in regard to the same, and a detailed statement of the expenses of such investigation. Presented 11th February, 1913.—*Mr. McKenzie*.. .. ..*Not printed.*

61 (6*s*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of Hugh D. McEachern, customs officer at north side East Bay, Cape Breton, in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to same, and a detailed statement of the expenses of such investigation. Presented 11th February, 1913.—*Mr. McKenzie*.. .. ..*Not printed.*

61 (6*t*). Return to an Order of the House of the 29th January, 1913, for a copy of all papers, documents, evidence, reports and correspondence relating to the dismissal of Thos. H. Hall, sub-collector of customs at Sheet Harbour, N.S. Presented 11th February, 1913.—*Mr. Maclean (Halifax)*.. .. ..*Not printed.*

61 (6*u*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of J. A. McNeil, customs officer at Grand Narrows, Nova Scotia, in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to same, and a detailed statement of the expenses of such investigation. Presented 11th February, 1913.—*Mr. McKenzie.*
Not printed.

61 (6*v*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of George Burchell, custom house officer at Sydney Mines, Nova Scotia, in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to same, and a detailed statement of the expenses of such investigation. Presented 11th February, 1913.—*Mr. McKenzie.*
Not printed.

61 (6*w*). Return to an Order of the House of the 15th January, 1913, for a copy of all papers, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of W. H. Saver, collector of customs at Cardinal, Ont., and the appointment of his successor. Presented 11th February, 1913.—*Mr. McMillan.*
Not printed.

CONTENTS OF VOLUME 27—*Continued.*

61 (6*x*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, telegrams and other documents relative to the dismissal of Captain George Livingstone, custom officer at Big Bras D'Or, Cape Breton, in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to same and a detailed statement of the expenses of such investigation. Presented 11th February, 1913.—*Mr. McKenzie.*
Not printed.

61 (*y*). Return to an Order of the House of the 10th December, 1912, for a copy of all correspondence, reports and other documents and papers relating to the dismissal of H. Lacasse, as postmaster at Wendover, County of Prescott, Ontario, and the appointment of his successor. Presented 13th February, 1913.—*Mr. Proulx*.. ..*Not printed*

61 (6*z*). Return to an Order of the House of the 9th December, 1912, for a copy of all correspondence and other papers connected with the removal of Harry A. Drigg, from the position of postmaster at Grassey Lake, Alberta. Presented 13th February, 1913.—*Mr. Buchanan*.. .. ..*Not printed*

61 (7*a*). Return to an Address to His Royal Highness the Governor General of the 9th December, 1912, for a copy of all papers, memoranda, orders in council, and correspondence relating to the dismissal of A. H. Stratton, late postmaster at Peterborough, Ont. Presented 17th February, 1913.—*Mr. Maclean* (*Halifax*).
Not printed

61 (7*b*). Return to an Order of the House of the 10th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Henry Burrell, postmaster, Yarmouth North, Yarmouth County, N.S., and the same information regarding the appointment of Henry Burrell's successor, and of the evidence taken and report of investigation held by Charles Lane in regard to the same, also a detailed statement of expenses of such investigation. Presented 18th February, 1913.—*Mr. Law*.. .. ..*Not printed.*

61 (7*c*). Return to an Order of the House of the 4th December, 1912, for a return showing all the postmasters dismissed by the present government in the County of Gloucester, the names of such persons, the reasons for their dismissal, nature of the charges made against them; also a copy of all correspondence connected with it, and reports of investigations in cases where such investigations were instituted. Presented 18th February, 1913.—*Mr. Turgeon*.. .. ..*Not printed.*

61 (7*d*). Return to an Order of the House of the 10th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Dr. Charles A. Webster, port physician at Yarmouth, County of Yarmouth N.S., and the same information regarding the appointment of Dr. Webster's successor. Presented 18th February, 1913.—*Mr. Law*.. .. ..*Not printed*

61 (7*e*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters, papers, charges and correspondence between the Department of Marine and Fisheries and all other persons, regarding the dismissal of Jos. Lord, keeper of lighthouses at Pointe à la Mule on the River Richelieu, Parish of St. Blaise, County of Saint Jean and Iberville and of all reports thereon with reference to the dismissal of the said Mr. Lord. Presented 19th February, 1913.—*Mr. Demers*.. .. .. ..*Not printed.*

61 (7*f*). Return to an Order of the House of the 15th January, 1913, for a copy of all correspondence, letters, telegrams and petitions concerning the dismissal of Henri Friolet, wharfinger at Caraquet, and Richard Southwood, wharfinger and agent of the Storm Signal Service at Bathurst, Gloucester County, N.B., and the appointment of their successors. Presented 19th February, 1913.—*Mr. Turgeon*.. .. .. ..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (7*g*). Return to an Order of the House of the 4th December, 1912, for a copy of all correspondence, letters, telegrams, reports and other documents, respecting the removal of Joseph L. Robichaud, lighthouse keeper at Miscou, County of Gloucester and the appointment of his successor; also of all correspondence respecting the engagement of the engineer of fog alarm system attached to that station, and the certificates required by the Minister of Marine, showing the competence of that engineer; with the names of the new keeper and of the said engineer and their ages. Presented 19th February, 1913.—*Mr. Turgeon*.. .. ..*Not printed.*

61 (7*h*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Captain Pope as lighthouse keeper at Scatarie, Cape Breton South, N.S., and of the evidence taken and reports of investigation held by H. P. Duchemin, in regard to the same. Presented 19th February, 1913.—*Mr. Carroll*.. .. ..*Not printed*

61 (7*i*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Captain W. W. Lewis, as shipping master at Louisburg, Cape Breton South, Nova Scotia, and of evidence taken and reports of investigation held by H. P. Duchemin, in regard to the same. Presented 19th February, 1913.—*Mr. Carroll.*
Not printed.

61 (7*j*). Return to an Order of the House of the 4th December, 1912, for a return showing the names of postmasters that have been dismissed in the County of Bonaventure since 1st October, 1911; the names of the postmasters who have been appointed to succeed them; the causes of the dismissals and a copy of all complaints and correspondence with respect to same, and of all reports of investigations where such have been held, with the reasons given for not holding any such investigation, when not held. Presented 19th February, 1913.—*Mr. Marcil*.. .. ..*Not printed*

61 (7*k*). Return to an Order of the House of the 15th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of George Hines, lighthouse keeper at South Ingonish, riding of North Cape Breton and Victoria, N.S., and of the evidence taken and reports of investigation held by H. P. Duchemin, in regard to the same, and a detailed statement of the expenses of such investigation. Presented 20th February, 1913.—*Mr. McKenzie*..*Not printed.*

61 (7*l*). Return to an Order of the House of the 15th January, 1913, for a return showing a list of the lighthouse keepers removed by the present government in the County of Two Mountains, the names of such persons, the reasons for their dismissal, the nature of the complaints made against them; also a copy of all correspondence and petitions relating thereto, and reports of inquiries in the cases, where such have been held; and also the names of their successors. Presented 20th February, 1913.—*Mr. Ethier*.. .. ..*Not printed.*

61 (7*m*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of Archibald McDonald, preventive officer at Mull River, Inverness County, Nova Scotia. Presented 20th February, 1913.—*Mr. Chisholm (Inverness)*..*Not printed.*

61 (7*n*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters, correspondence on file referring to the dismissal of Donald Chisholm, of Tracadie, in the County of Antigonish, as preventive officer. Presented 20th February, 1913.—*Mr. Chisholm (Antigonish)*... .. ..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (*7o*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters, telegrams, reports and other documents relative to the dismissal of Edward C. Humphreys, of Trenton, N.S., as an officer of the Inland Revenue Department and to the appointment of his successor. Presented 20th February, 1913.—*Mr. Macdonald.* *Not printed.*

61 (*7p*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of H. J. Fixott, port physiciau at Arichat, Richmond County, N.S. Presented 21st February, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61 (*7q*). Return to an Order of the House of the 10th December, 1912, for a copy of all correspondence, letters, telegrams and other documents relatiug to the dismissal of D. Morin as postmaster of St. Pie de Bagot, County of Bagot. Presented 21st February, 1913.—*Mr. Marcil (Bagot)*.. .. ..*Not printed.*

61 (*7r*). Return to an Order of the House of the 10th December, 1912, for a copy of all correspondence, investigations and papers generally concerning the dismissal of Ernest Paquin, postmaster of St. Cecile de Levrard, County of Nicolet. Presented 21st February, 1913.—*Mr. Lemieux*.. .. ..*Not printed.*

61 (*7s*). Return to an Address to His Royal Highness the Governor General of the 17th February, 1913, for a copy of all complaints and charges made against John R. Mc Donald, Indian agent at Heatherton, Antigonish County, of the recommendations t council and of the order in council made thereon, and of all letters, correspondence, and documents connected in any way with his dismissal. Presented 25th February, 1913.—*Mr. Chisholm (Antigonish)*... .. ..*Not printed.*

61 (*7t*). Return to an Order of the House of the 15th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of Joseph Day, customs officer at Little Bras D'Or, C.B., in the riding of North Cape Breton and Victoria, and of the evideuee taken and report of investigation held by H. P. Duchemin, in regard to same, and a detailed statement of the expenses of such investigation. Presented 25th February, 1913.—*Mr. McKenzie*.. .. ..*Not printed.*

61 (*7u*). Return to an Address to His Royal Highness the Governor General of the 29th January, 1913, for a copy of all complaints against Duncau McLeod, appraiser of customs at Sherbrocke, Province of Quebec, of all information obtained as to his conduct through seizures of goods by special officers of customs and by investigation; of all reports of iuvestigation; of the order iu council dismissing said Duncan McLeod; and of all correspondence between him and the Department of Customs. Presented 25th February, 1913.—*Mr. McCrae*.. .. ..*Not printed.*

61 (*7v*). Return to an Order of the House of the 17th February, 1913, for a copy of all papers, letters, telegrams, evideuce, &c., given at the investigation or investigations and of reports of such investigations, relating to the dismissal of Edouard D Chiasson, sub-collector of customs at Lamèque, Gloucester County, and the appointment of his successor. Presented 25th February, 1913.—*Mr. Turgeon*.. ..*Not printed.*

61 (*7w*). Return to an Order of the House of the 15th January, 1913, for a copy of all papers, letters, telegrams, evidence and other documents regarding the dismissal of George F. Briggs, customs officer at McAdam Junction, York Couuty, N.B. Presented 25th February, 1913.—*Mr. Carvell*.. .. ..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (7*x*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of William A. Duan, lightkeeper at Green Island, Richmond County, Nova Scotia, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of such investigation. Presented 25th February, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61 (7*y*). Return to an Order of the House of the 29th January, 1913, for a copy of all papers, charges, correspondence, letters, telegrams and other documents relating to the dismissal of Thomas Cameron, preventive officer at Andover, N.B., and of the evidence taken and reports of investigation held by Mr. E. T. C. Knowles, in connection with the same. Presented 26th February, 1913.—*Mr. Michaud*.. .. ..*Not printed.*

61 (7*z*). Return to an Order of the House of the 29th January, 1913, for a copy of all complaints and charges made against Joseph McDonald, late of the customs office at Sydney, Cape Breton, Nova Scotia, and of all letters, telegrams and correspondence relating in any way to his dismissal and the appointment of his successor. Presented 26th February, 1913.—*Mr. Carroll*.. .. ..*Not printed*

61 (8*a*). Return to an Order of the House of the 29th January, 1913, for a copy of all complaints and charges made against Angus McGillivray, late of customs office at Glace Bay, Cape Breton South, Nova Scotia, and of all letters, telegrams and correspondence relating in any way to his dismissal and the appointment of his successor. Presented 26th February, 1913.—*Mr. Carroll*.. .. ..*Not printed.*

61 (8*b*). Return to an Order of the House of the 3rd February, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of Roderick Bain, boatman at New Campbellton, riding of North Cape Breton and Victoria, N.S., and of the evidence taken and reports of the investigation held by H. P. Duchemin, in regard to same, with a detailed statement of expenses of such investigation. Presented 26th February, 1913.—*Mr. McKenzie*.. .. ..*Not printed.*

61 (8*c*). Return to an Order of the House of the 15th January, 1913, for a copy of all papers, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of W. A. Scott, lockmaster at Cardinal, Ontario, and of the appointment of his successor. Presented 27th February, 1913.—*Mr. McMillan.* *Not printed.*

61 (8*d*). Return to an Order of the House of the 27th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Bert Johnson, lockman at Nicholson, Ontario. Presented 27th February, 1913.—*Mr. Turgeon*.. .. ..*Not printed.*

61 (8*e*). Return to an Order of the House of the 27th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of John Merrifield, lockmaster at Burritts Rapids, Ont., and the appointment of his successor. Presented 27th February, 1913.—*Mr. Chisholm.* *Not printed.*

61 (8*f*). Return to an Order of the House of the 15th January, 1913, for a copy of all papers, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Neil Cummings, lockmaster at Cardinal, Ontario, and of the appointment of his successor. Presented 27th February, 1913.—*Mr. McMillan*.. .. ..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (8*g*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters, papers, charges and correspondence between the Department of Railways and Canals and all other persons, regarding the dismissal of Mr. François Chagnon, lockkeeper at Saint Jean, County of Saint Jean and Iberville, and of all reports thereon with reference to the dismissal of the said Mr. Chagnon. Presented 27th February, 1913.—*Mr. Demers*.. .. ..*Not printed.*

61 (8*h*). Return to an Order of the House of the 15th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of Neil McNeil, bridge tender, Intercolonial railway, at Grand Narrows in the riding of North Cape Breton and Victoria. Presented 27th February, 1913.—*Mr. McKenzie*.. .. ..*Not printed.*

61 (8*i*). Return to an Order of the House of the 15th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of Archibald McKenzie, sectionman, Intercolonial railway, at Grand Narrows, in the riding of North Cape Breton and Victoria. Presented 27th February, 1913.—*Mr. McKenzie*.. .. ..*Not printed.*

61 (8*j*). Return to an Order of the House of the 15th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of John Fraser, bridge tender, Intercolonial railway, at Grand Narrows, in the riding of North Cape Breton and Victoria. Presented 27th February, 1913.—*Mr. McKenzie*.. .. ..*Not printed.*

61 (8*k*). Return to an Order of the House of the 27th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Demetrius Crozier, lockman at Merrickville, Ontario. Presented 27th February, 1913.—*Mr. Proulx*.. .. ..*Not printed.*

61 (8*l*). Return to an Order of the House of the 27th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Patrick Cussuk, lockman at Merrickville, Ontario Presented 27th February, 1913.—*Mr. Michaud*.. .. ..*Not printed.*

61 (8*m*). Return to an Order of the House of the 27th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Joseph H. Webster, lockman at Nicholson, Ontario. Presented 27th February, 1913.—*Mr. Pacaud*.. .. ..*Not printed.*

61 (8*n*). Return to an Order of the House of the 27th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Cyrus O'Neil, lockman at Nicholson, Ontario. Presented 27th February, 1913.—*Mr. Kyte*... .. ..*Not printed.*

61 (8*o*). Return to an Order of the House of the 27th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Michael Laughtin, bridgeman at Burritts Rapids, Ontario. Presented 27th February, 1913.—*Mr. Papineau*.. .. ..*Not printed.*

61 (8*p*). Return to an Order of the House of the 27th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of John McKay, bridgeman at Becketts, Ontario. Presented 27th February, 1913.—*Mr. Lanctot*.. .. ..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (8*q*). Return to an Order of the House of the 27th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Edward Proctor, lockman at Burritts Rapids, Ont. Presented 27th February, 1913.—*Mr. Neely*.. .. ..*Not printed.*

61 (8*r*). Return to an Order of the House of the 27th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of William Morrison, lockman at Burritts Rapids, Ont. Presented 27th February, 1913.—*Mr. Cash*.. .. ..*Not printed.*

61 (8*s*). Return to an Order of the House of the 15th January, 1913, for a copy of all letters, documents, telegrams, reports, correspondence and recommendations in any way relating to the dismissal of Adam Henderson, bridgemaster at Cardinal, Ontario, and of the appointment of his successor. Presented 27th February, 1913.—*Mr. Murphy.* *Not printed.*

61 (8*t*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of James Feehan, fishery guardian or warden at Tracadie Harbour and Savage Harbour, Prince Edward Island. Presented 27th February, 1913.—*Mr. Hughes* (*Kings, P.E.I.*).. .. ..*Not printed*

61 (8*u*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of John C. McNeil, lighthouse keeper at Grand Narrows, in the riding of North Cape Breton and Victoria. Presented 27th February, 1913.—*Mr. McKenzie.* *Not printed*

61 (8*v*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of A. A. Chisholm, fishery overseer at Margaree Forks, Inverness County, Nova Scotia. Presented 28th February, 1913.—*Mr. Chisholm* (*Inverness*).. ..*Not printed.*

61 (8*w*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of Charles E. Aucoin, collector of customs at Cheticamp, Inverness County, Nova Scotia, and of the evidence taken and report of investigation held by Mr. H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of such investigation. Presented 28th February, 1913.—*Mr. Chisholm* (*Antigonish*). *Not printed.*

61 (8*x*). Return to an Order of the House of the 17th February, 1913, for a copy of all complaints and charges made against Charles L. Gass, late postmaster at Bayfield, Antigonish County, of the evidence taken, if any, before Commissioner Duchemin, and of his report thereon and of all letters, telegrams and documents of every kind relating to his dismissal and the appointment of his successor. Presented 28th February, 1913.—*Mr. Chisholm* (*Antigonish*).. .. ..*Not printed.*

61 (8*y*). Return to an Order of the House of the 17th February, 1913, for a copy of all letters and correspondence exchanged in reference to the dismissal of Cyprien Martin, of St. Basile, County of Madawaska, N.B., between the Department of Customs and the said Mr. Martin as preventive officer. Presented 28th February, 1913.—*Mr. Michaud*.. .. ..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (8z). Return to an Order of the House of the 9th December, 1912, for a copy of all complaints and charges made against Angus A. Boyd, postmaster at Boyd's post office, Antigonish County, Nova Scotia, and of all letters, telegrams and correspondence relating in any way to his dismissal, and the appointment of a successor. Presented 28th February, 1913.—*Mr. Chisholm (Antigonish)*.. .. ..*Not printed.*

61 (9*a*). Return to an Order of the House of the 9th December, 1912, for a copy of all complaints and charges made against John B. Macdonald, postmaster at Glasburn, Antigonish County, Nova Scotia, and of all letters, telegrams and correspondence relating in any way to his dismissal, and the appointment of a successor. Presented 28th February, 1913.—*Mr. Chisholm (Antigonish)*.. .. ..*Not printed*

61 (9*b*). Return to an Order of the House of the 9th December, 1912, for a copy of all complaints and charges made against Alex. G. Chisholm, postmaster at Ohio, Antigonish County, Nova Scotia, and of all letters, telegrams and correspondence relating in any way to his dismissal, and the appointment of a successor. Presented 28th February, 1913.—*Mr. Chisholm (Inverness)*.. .. ..*Not printed*

61 (9*c*). Return to an Order of the House of the 9th December, 1912, for a copy of all complaints and charges made against John J. McLean, postmaster at Cross Roads, Ohio, Antigonish County, Nova Scotia, and of all letters, telegrams and correspondence relating in any way to his dismissal and the appointment of a successor. Presented 28th February, 1913.—*Mr. Chisholm (Inverness)*.. .. ..*Not printed*

61 (9*d*). Return to an Order of the House of the 9th December, 1912, for a copy of all complaints and charges made against Dougald McDonald, postmaster at Doctors Brook, Antigonish County, Nova Scotia, and of all letters, telegrams and correspondence relating in any way to his dismissal, and the appointment of his successor. Presented 28th February, 1913.—*Mr. Chisholm (Antigonish)*.. .. ..*Not printed.*

61 (9*e*). Return to an Order of the House of the 9th December, 1912, for a copy of all complaints and charges made against Dan. A. McInnes, postmaster at Georgeville, Antigonish County, Nova Scotia, and of all letters, telegrams, and correspondence relating in any way to his dismissal, and the appointment of his successor. Presented 28th February, 1913.—*Mr. Chisholm (Antigonish)*.. .. ..*Not printed.*

61 (9*f*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, letters, correspondence, telegrams and other documents relating to the dismissal of E. A. Asker, harbour master at Campbellton. Presented 3rd March, 1913.—*Mr. Reid (Restigouche)*.. .. ..*Not printed.*

61 (9*g*). Return to an Order of the House of the 10th February, 1913, for a copy of all papers, letters, documents and orders relative to the dismissal of Fred Shultz as caretaker of the armouries at Kentville, Nova Scotia, and of the appointment of William Shoop in his place and also for a statement of the stores in said armouries in the years 1910, 1911, 1912, respectively, and for a copy of all orders and regulations relative to the duties of such caretaker. Presented 3rd March, 1913.—*Mr. Macdonald. Not printed.*

61 (9*h*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Dr. Freeman O'Neil, from the Marine Hospital a Louisburg, Cape Breton South, N.S., and of evidence taken and reports of investigation held by H. P. Duchemin, in regard to the same. Presented 10th March, 1913.—*Mr. Carroll*..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (9*i*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Leon N. Poirier, wharfinger at Descouse, Richmond County, N.S. Presented 10th March, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61 (9*j*). Return to an Order of the House of the 10th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Norman L. Trefry, shipping master at Yarmouth, County of Yarmouth, N.S., and the same information regarding the appointment of Mr. Trefry's successor Presented 10th March, 1913.—*Mr. Law*.. .. ..*Not printed.*

61 (9*k*). Return to an Order of the House of the 15th January, 1913, for a copy of all papers, documents, correspondence, &c., relating to the dismissal of James Amereau[1r], lighthouse keeper at New Edinburgh, Digby County, N.S. Presented 10th March, 1913. *Mr. McLean (Halifax)*.. .. ..*Not printed*

61 (9*l*). Return to an Order of the House of the 29th January, 1913, for a copy of all papers, documents, evidence, reports, letters, correspondence, &c., relating to the dismissal of H. B. Manley, a clerk in the Dominion Lands Office at Saskatoon. Presented 10th March, 1913.—*Mr. McCraney*.. .. ..*Not printed.*

61 (9*m*). Return to an Order of the House of the 29th January, 1913, for a copy of all correspondence, letters, telegrams, papers and other documents in connection with the dismissal of John Spicer, senior assistant of the Moosejaw Land Agency. Presented 10th March, 1913.—*Mr. Knowles*.. .. ..*Not printed.*

61 (9*n*). Return to an Order of the House of the 29th January, 1913, for a copy of all papers, letters, telegrams and other documents respecting the dismissal of Robert Pragnall from the position of agent of the Dominion Land Office at Swift Current and the appointment of his successor. Presented 10th March, 1913.—*Mr. Knowles.*
Not printed.

61 (9*o*). Return to an Order of the House of the 29th January, 1913, for a copy of all papers, documents, evidence, reports, letters, correspondence, &c., relating to the dismissal of G. M. Ullyot, a clerk in the Dominion Lands Office at Saskatoon. Presented 10th March, 1913.—*Mr. McCraney*.. .. ..*Not printed*

61 (9*p*). Return to an Order of the House of the 9th December, 1912, for a return showing the detail and number of dismissals from public offices by the present government to this date in the riding of Saskatoon, with the names of the dismissed occupants, the reasons for their dismissals, the complaints against such officials, and all correspondence with respect to the same, and of all reports of investigations, in case where such were held. Presented 17th March, 1913.—*Mr. McCraney*.. .. ..*Not printed*

61 (9*q*). Return to an Order of the House of the 17th February, 1913, for a copy of all letters, petitions, telegrams, complaints, evidence, reports, affidavits and other documents in the Department of Inland Revenue, respecting the dismissal of J. N. Poirier, Collector of Excise at Victoriaville, County of Arthabaska, and the names of the witnesses interested, with a copy of the evidence and a statement of expenses of the said inquiry. Presented 17th March, 1913.—*Mr. Brouillard*.. .. ..*Not printed.*

61 (9*r*). Return to an Order of the House of the 15th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of John G. Morrison, fishery inspector at Englishtown, in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to same, and a detailed statement of the expenses of such investigation. Presented 18th March, 1913.—*Mr. Kyte*.. .. ..*Not printed*

CONTENTS OF VOLUME 27—*Continued.*

61 (9*s*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Edward Landry, lightkeeper, Petite de Grat, Richmond County, N.S., and of all evidence taken and report of investigation held by H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of such investigation. Presented 18th March, 1913.—*Mr. Kyte*.. .. ..*Not printed.*

61 (9*t*). Return to an Order of the House of the 27th January, 1913, for a copy of all documents, petitions, letters, correspondence, inquiries and reports concerning the dismissal of Evariste Talbot, employed in the general freight office of the Intercolonial. Presented 18th March, 1913.—*Mr. Lapointe (Kamouraska)*.....*Not printed*

61 (9*u*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters, petitions, telegrams, complaints, evidence, reports and other papers and documents in the possession of the Department of Railways or any department of the government, relating to the dismissal of Philip H. Ryan, an employee of the Intercolonial railway at Mulgrave, N.S., and if there was an investigation, the names of all witnesses examined, a copy of the evidence, and a detailed statement of the expenses of such investigation. Presented 18th March, 1913.—*Mr. Sinclair*..*Not printed.*

61 (9*v*). Return to an Order of the House of the 3rd February, 1913, for a return showing how many postmasters and other post office employees were removed from office respectively, from the 1st of July, 1896, to the 1st of October, 1911, and the number in each province; and from the 10th of October, 1911, up to date, with the number in each province; also the number of post offices in operation in each proviuce on the 1st July, 1896. Presented 26th March, 1913.—*Mr. Rainville*.....*Not printed.*

61 (9*w*). Return to an Address to His Royal Highness the Governor General of the 3rd February, 1913, for a copy of all orders in council, and of all letters, telegrams, complaints, petitions and of all other documents of any kind, in the possession of the government, or of any department or official thereof, in any way relating to or concerning the dismissal of Dr. Clarence T. Campbell, post office inspector at London, Ontario. Presented 26th March, 1913.—*Mr. Rass*.....*Not printed.*

61 (9*x*). Return to an Order of the House of the 9th December, 1912, for a return showing the number of postmasters that have been dismissed in the County of Missisquoi since 1st October, 1911, the names of the postmasters who have been appointed to succeed them, the cause of the dismissals and a copy of all complaints and correspondence with respect to the same, and of all reports of investigations where such have been held. Presented 26th March, 1913.—*Mr. Kay*.....*Not printed.*

61 (9*y*). Return to an Order of the House of the 27th January, 1913, for a copy of all letters, petitions, telegrams, complaints, evidence, reports and other papers and documents in the possession of the Post Office Department, regarding any change in any post office or postmastership in Bonaventure County, between 5th December, 1912, up to date. Presented 26th March, 1913.—*Mr. Marcil (Bonaventure)*.....*Not printed.*

61 (9*z*). Return to an Address to His Royal Highness the Governor General of the 9th December, 1912, for a copy of all papers, documents, correspondence, orders in council, &c., relative to the dismissal of S. A. Johnson, late postmaster at Petite Rivière, Lunenburg County, N.S. Presented 26th March, 1913.—*Mr. MacLean (Halifax)*. *Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (10*a*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams, and other documents relative to the dismissal of Murdock McKenzie, postmaster at Millville Boulardarie, Nova Scotia, in the riding of North Cape Breton and Victoria. Presented 26th March, 1913.—*Mr. McKenzie* .....*Not printed.*

61 (10*b*). Return to an Order of the House of the 9th December, 1912, for a copy of all documents, correspondence and telegrams relating to the dismissal of James Stewart, postmaster at Middleton, Antigonish County, and the appointment of his successor. Presented 26th March, 1913.—*Mr. Chisholm (Antigonish)*.....*Not printed*

61 (10*c*). Return to an Order of the House of the 9th December, 1912, for a copy of all correspondence, telegrams and reports relating to the dismissal of Lauchlin McNeil, postmaster at New France, County of Antigonish, and the appointment of his successor. Presented 26th March, 1913.—*Mr. Chisholm (Antigonish)*.....*Not printed.*

61 (10*d*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams, and other documents relative to the dismissal of Frank Dunlop, postmaster at Groves Point, Nova Scotia, in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to same, and a detailed statement of the expense of such investigation. Presented 26th March, 1913.—*Mr. McKenzie.*

Not printed.

61 (10*e*). Return to an Order of the House of the 10th December, 1912, for a copy of all letters, telegrams, complaints, petitions and other documents relating to the investigation of A. W. Salsman, postmaster at Middle Country Harbour, N.S., and to the appointment of his successor. Presented 26th March, 1913.—*Mr. Sinclair.*

Not printed.

61 (10*f*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Richard Conroy, postmaster at Cross Roads, County Harbour, Guysborough County, N.S., and of all evidence taken and report of investigation held by H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of such investigation. Presented 26th March, 1913.—*Mr. Sinclair*.....*Not printed.*

61 (10*g*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Abner Carr, postmaster at St. Francis Harbour, Guysborough County, N.S., and of all evidence taken and report of investigation held by H. P. Duchemin, in regard to the same; also a detailed statement of expenses of such investigation. Presented 26th March, 1913.—*Mr. Sinclair*.....*Not printed.*

61 (10*h*). Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Parker Sangster, postmaster, Upper New Harbour, Guysborough County, NS., and of all evidence taken and report of investigation held by H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of such investigation. Presented 26th March, 1913.—*Mr. Sinclair*.....*Not printed.*

61 (10*i*). Return to an Address to His Royal Highness the Governor General of the 4th December, 1912, for a copy of all correspondence, orders in council and all other papers or documents in any way relating to the dismissal of Alexander Marion, from the position of postmaster at Rockland, Ontario. Presented 26th March, 1913.—*Mr. Murphy* .....*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (10*j*). Return to an Order of the House of the 4th Decemher, 1912, for a copy of the evidence taken and the report made by each commissioner appointed since 1st of November, 1911, to conduct an investigation into charges of offensive partizanship made against postmasters in the County of Russell. Presented 26th March, 1913.—*Mr. Murphy* .....*Not printed.*

61 (10*k*). Return to an Order of the House of the 9th Decemher, 1912, for a copy of all papers, documeuts, evidence, reports, findings and correspondence, relating to the dismissal of Mathew Bontilier, recently postmaster at Mushaboom, Halifax Conuty, N.S. Presented 26th March, 1913.—*Mr. MacLean (Halifax)*.....*Not printed*

61 (10*l*). Return to an Order of the Honse of the 29th January, 1913, for a retnrn showing the names of the postmasters in the County of Joliette, who have heen dismisse'l from 1896 to September, 1911; their respective parishes; dates of their dismissals; the reasons alleged; whether an inqniry was made in each case; on whose recommendation in each case the dismissals were made; names of successors in each case, and on whose recommendation were they appointed. Presented 26th March, 1913.—*Mr. Guilbault.* *Not printed.*

61 (10*m*). Return to an Order of the House of the 29th January, 1913, for a copy of all papers, documents, evidence, reports, letters, correspondence, &c., relating to the dismissal of T. Doane Crowell, postmaster at Shag Harbonr, Shelburne County, N.S., and the appointment of his successor. Presented 26th March, 1913.—*Mr. Law.* *Not printed*

61 (10*n*). Retnrn to an Order of the House of the 22nd January, 1913, for a return showing the postmasters who have hcen dismissed in the County of Vaudreuil, the dates of their appointment, the cause of their dismissal aud by whom their dismissal was requested. Presented 26th March, 1913.—*Mr. Boyer*.....*Not printed.*

61 (10o). Retnrn to an Order of the House of the 29th January, 1913, for a copy of all papers, documents, letters, correspondence, &c., relating to the dismissal of Mrs. Spiuney, postmistress at Upper Port La Tour, Shelbnrne County, N.S. Presented 26th March, 1913.—*Mr. Law*.....*Not printed.*

61 (10*p*). Return to an Order of the House of the 29th January, 1913, for a return showing the number of postmasters dismissed in the County of Rimonski since 21st Septemher, 1911, giving their names. Presented 26th March, 1913.—*Mr. Lapointe (Kamouraska)* .....*Not printed.*

61 (10*q*). Return to an Order of the House of the 4th December, 1912, for a return showing the detail and number of dismissals from public offices by the present government to this date in the riding of Wright, giving the names of the dismissed occupants, the reasons for their dismissal, the complaiuts against such officials, and a copy of all correspondence with respect to the same, with all reports of investigations where such were held. Presented 27th March, 1913.—*Mr. Devlin*.....*Not printed*

61 (10*r*). Return to an Order of the House of the 29th Jannary, 9113, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of John R. McLenuan, janitor of the public building at Inverness Town, Inverness County, Nova Scotia, and of the evidence taken and report of investigation held by Mr. H. P. Dnchemin, in regard to the same; also a detailed statement of the expenses of such investigation. Presented 28th March, 1913.—*Mr. Chisholm (Inverness)*.....*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (10*s*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters, and other documents relating to the dismissal of James Arbuckle, caretaker of the public buildings at Pictou, and the appointment of two successors in his stead. Presented 28th March, 1913.—*Mr. Macdonald*.....*Not printed.*

61 (10*t*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams, and other documents relative to the dismissal of Mary Dunlop, telegraph operator at Groves Point, Cape Breton County, Nova Scotia, in the riding of North Cape Breton and Victoria. Presented 28th March, 1913.—*Mr. McKenzie* .....*Not printed.*

61 (10*u*). Return to an Order of the House of the 4th December, 1912, for a return showing the foremen employed at the various public works in the County of Gloucester on the 21st of September, 1911, who have been dismissed since by the present administration, containing their names, reasons of dismissal, nature of the charges made against them, also a copy of all correspondence connected with the same and reports of inquiries, in cases where such inquiries have been instituted. Presented 28th March, 1913.—*Mr. Turgeon*.....*Not printed*

61 (10*v*). Return to an Order of the House of the 3rd February, 1913, for a copy of all letters, telegrams, papers and documents relative to the dismissal of Captain Lyons of the dredge *Northumberland*, and the appointment of his successor. Presented 28th March, 1913.—*Mr. Macdonald*.....*Not printed.*

61 (10*w*). Return to an Address to His Royal Highness the Governor General of the 4th December, 1912, for a copy of all correspondence, orders in council and all other papers or documents in any way relating to the dismissal of James McCartin, from the position of inspector of the concrete work forming part of the contract for the construction of the The Plaza at the City of Ottawa Presented 28th March, 1913.—*Mr. Murphy* .....*Not printed.*

61 (10*x*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Robert C. Morrison, postmaster at St. Peters, Richmond County, N.S., and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of such investigation, together with a copy of all recommendations, letters, telegrams and other papers relating to the appointment of Mr. Morrison's successor. Presented 31st March, 1913.—*Mr. Kyte*. *Not printed*

61 (10*y*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams, and other documents relative to the dismissal of Richard Dugas, storm signal attendant at Alder Point, Nova Scotia, in the riding of North Cape Breton and Victoria. Presented 4th April, 1913.—*Mr. McKenzie*. *Not printed.*

61 (10*z*). Return to an Order of the House of the 20th January, 1913, for a return showing the names of all officials of the Marine and Fisheries Department who have been dismissed or removed in the County of Pictou, the reasons of the same, the evidence taken at any investigation held in regard to them, and the reports of said investigations, the names of their successors, and a copy of all letters, charges, complaints and recommendations from any person or persons in regard to the said removals or dismissals, or in regard to the appointment of their successors. Presented 4th April 1913.—*Mr. Macdonald*.....*Not printed*

CONTENTS OF VOLUME 27—*Continued.*

61 (11*a*). Return to an Order of the House of the 3rd March, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of William L. Munro, lightkeeper at White Head, Guysborough County, N.S., and of all evidence taken and report of investigation held by H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of such investigation. Presented 4th April, 1913.—*Mr. Sinclair*.....*Not printed.*

61 (11*b*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters, telegrams, correspondence, reports and documents touching the dismissals of Alexander R. McAdam as fishery officer for the County of Antigonish, N.S., and the appointment of his successor. Presented 4th April, 1913.—*Mr. Chisholm (Antigonish).* *Not printed.*

61 (11*c*). Return to an Order of the House of the 19th February, 1913, for a copy of all letters, petitions, telegrams, complaints, evidence, reports and other papers and documents in the possession of the Marine and Fisheries Department, or any department of the government, relating to the dismissal of Stephen C. Richard, lightkeeper at Charlos Cove, N.S., and if there was an investigation, the names of all witnesses examined, a copy of the evidence, and a detailed statement of the expenses of such investigation. Presented 4th April, 1913—*Mr. Sinclair*.....*Not printed.*

61 (11*d*). Supplementary to an Order of the House of the 7th February, 1912, for a return showing for each department of the government the names, post office addresses, offices, employment, and salaries of all persons employed either in the inside or outside service thereof, and of such persons not in the Civil Service, employed by the government in any department, on the tenth day of October, 1911, who have been removed from office or employment by dismissal; specifying in each case the manner of and grounds of such dismissals and the length of notice given to the persons removed, and also indicating in each case whether an inquiry was or was not held prior to such dismissal. Presented 7th April, 1913.—*Mr. Kyte*.....*Not printed.*

61 (11*e*). Return to an Order of the House of the 7th December, 1912, for a return showing the public officers removed by the present government in the district of Lotbinière, with the names and duties of such persons, the reasons of their dismissal. the nature of the complaints made against them, also a copy of all correspondence relating thereto and reports of inquiries in the cases where such inquiries have been held. Presented 9th April, 1913.—*Mr. Fortier*.....*Not printed*

61 (11*f*). Return to an Order of the House of the 29th January, 1913, for a copy of all complaints and charges made against Miss Gertie Lewis, as postmistress at Main-a dieu, Cape Breton South, N.S., and of all letters, telegrams and correspondence relating in any way to her dismissal and the appointment of a successor. Presented 9th April, 1913.—*Mr. Carroll* .....*Not printed.*

61 (11*g*). Return to an Order of the House of the 11th December, 1912, for a copy of all correspondence, letters, telegrams and other documents relating to the dismissal of John Taylor, late postmaster at Carnduff, Sask., and of all reports of investigation held, &c. Presented 9th April, 1913.—*Mr. Turriff*.....*Not printed.*

61 (11*h*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Frederick Mitchell, from the position of postmaster at Dominion, Cape Breton South, N.S., and of the evidence taken and reports of investigation held by H. P. Duchemin, in regard to the same. Presented 9th April, 1913.—*Mr. Carroll.* *Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (11*i*). Return to an Order of the House of the 29th January, 1913, for a copy of all papers, letters, telegrams and other correspondence relating to the dismissal of Thomas J. Sears, postmaster at Lochaber, N.S., and the appointment of his successor; of the evidence taken, and of the report thereon made by Commissioner Duchemin, on the charges, if any, made against the dismissed postmaster. Presented 9th April, 1913.—*Mr. Chisholm (Antigonish)*.. .. ..*Not printed.*

61 (11*j*). Return to an Order of the House of the 29th January, 1913, for a copy of all correspondence, letters, telegrams, papers and other documents in connection with the dismissal of the postmaster at Alsask, Saskatchewan. Presented 9th April, 1913.—*Mr. Knowles*.....*Not printed*

61 (11*k*). Return to an Order of the House of the 3rd March, 1913, for a copy of all letters, telegrams, instructions and other papers and documents in the possession of the Department of Marine and Fisheries, or any officer thereof, relating to the dismissal or appointment of fishery guardians or fishery officers, in the County of Guysborough, N.S., bearing date since the 10th day of October, 1911. Presented 9th April, 1913.—*Mr. Sinclair*.....*Not printed*

61 (11*l*). Return to an Order of the House of the 11th December, 1912, for a copy of all complaints and charges made against John R. Morrison, postmaster at Oban, Richmond County, N.S., and of all letters, telegrams and correspondence relating in any way to his dismissal, and the appointment of a successor. Presented 14th April, 1913.—*Mr. Kyte*.....*Not printed.*

61 (11*m*). Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of A. G. McDonald, postmaster of North East Margaree, Inverness County, Nova Scotia, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of such investigation. Presented 14th April, 1913.—*Mr. Chisholm (Inverness)*..*Not printed.*

61 (11*n*). Return to an Order of the House of the 9th December, 1912, for a return showing in detail the number of dismissals from public office by the present government to this date, in the constituency of Qu'Appelle, with the names of the dismissed officers, and the reason for their dismissal, the complaints against such officials and a copy of all correspondence, petitions, papers and documents with respect to the same, and of all notes of evidence and reports of investigations in cases where they have taken place. Presented 14th April, 1913.—*Mr. Thomson (Qu'Appelle)*.....*Not printed*

61 (11*o*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters, petitions, telegrams, complaints, evidence, reports and other papers and documents in the possession of the Department of Marine and Fisheries or any department of the government, relating to the dismissal of David Reid, fishery officer at Port Hilford, N.S., and if there was an investigation, the names of the witnesses examined, a copy of the evidence, and a detailed statement of the expenses of each investigation. Presented 15th April, 1913.—*Mr. Sinclair*.....*Not printed.*

61 (11*p*). Return to an Order of the House of the 15th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Robert Musgrave, postmaster at North Sydney, in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to same, and a detailed statement of the expenses of such investigation. Presented 15th April, 1913.—*Mr. McKenzie*.....*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (11*q*). Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of A. D. Archibald, postmaster at Glenelg, Guysborough County, N.S., and of all evidence taken and report of investigation held by H. P. Duchemin in regard to the same; also a detailed statement of the expenses of such investigation. Presented 15th April, 1913.—*Mr. Chisholm (Inverness)*.....*Not printed*

61 (11*r*). Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Leon N. Poirier, postmaster at Descouse, Richmond County, N.S., and of the evidence taken and of the reports of investigation held by H. P. Duchemin in regard to the same and a detailed statement of the expenss of such investigation; and a copy of all papers relating to the appointment of his successor. Presented 15th April, 1913.—*Mr. Kyte*.....*Not printed.*

61 (11*s*). Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Norman McAskill, postmaster at Framboise, Richmond County, N.S., and of the evidence taken and of the report of investigation held by H. P. Duchemin in regard to the same, and a detailed statement of the expenses of such investigation; and a copy of all papers relating to the appointment of his successor. Presented 15th April, 1913.—*Mr. Kyte*.....*Not printed.*

61 (11*t*). Return to an Order of the House of the 11th December, 1912, for a copy of all papers, documents and correspondence relating to the dismissal of A. T. Doucet, postmaster and collector of customs at Salmon River, Digby County, N.S. Presented 15th April, 1913.—*Mr. Maclean (Halifax)*.. .. ..*Not printed.*

61 (11*u*). Return to an Order of the House of the 29th January, 1913, for a copy of all complaints and charges made against Mrs. Annie Gallivan, as postmistress at Whitney Pier, Cape Breton South, Nova Scotia, and of all letters, telegrams and correspondence relating in any way to her dismissal and the appointment of a successor. Presented 15th April, 1913.—*Mr. Carroll*.....*Not printed.*

61 (11*v*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Wm. J. Paquet, postmaster at Souris, P.E.I. Presented 15th April, 1913.—*Mr. Hughes (Kings, P.E.I.)*.. .. ..*Not printed.*

61 (11*w*). Return to an Order of the House of the 27th January, 1913, for a copy of all documents, correspondence, petitions and recommendations, &c., relating to the dismissal of the postmaster at St. Anaclet, County of Rimouski, during the year 1912, and of the appointment of his successor. Presented 15th April, 1913.—*Mr. Lapointe (Kamouraska)*.. .. ..*Not printed*

61 (11*x*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of George Gunn, postmaster at French Village, Prince Edward Island. Presented 15th April, 1913.—*Mr. Hughes (Kings, P.E.I.)*.. .. ..*Not printed.*

61 (11*y*). Return to an Order of the House of the 4th December, 1912, for a return showing the detail and number of dismissals from public offices by the present government to this date in the riding of Mackenzie, together with the names of the dismissed occupants, the reasons for their dismissal, the complaints against such officials, and a copy of all correspondence with respect to the same, and of all reports of investigations, where any such were held. Presented 15th April, 1913.—*Mr. Cash*..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (11*z*). Return to an Order of the House of the 7th April, 1913, for a copy of all charges investigated by Commissioner W. J. Code, and also of the evidence taken and the report made by the said commissioner. Presented 16th April, 1913.—*Mr. Murphy.*
Not printed.

61 (12*a*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of D. F. McLean, fishery overseer at Port Hood, Inverness County, N.S., and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of such investigation. Presented 16th April, 1913.—*Mr. Chisholm (Inverness).....Not printed*

61 (12*b*). Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of J. Scott Nelson, postmaster at Louisdale, Richmond County, N.S., and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to the same, and a detailed statemeut of the expenses of such investigation; and a copy of all papers relating to the appointment of his successor. Presented 16th April, 1913. —*Mr. Kyte.....Not printed*

61 (12*c*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Joseph McMullen, from the post office at Bridgeport, Cape Breton South, Nova Scotia, and of evidence taken and reports of investigation held by H. P. Duchemin, in regard to the same. Presented 16th April, 1913.—*Mr. Carroll....Not printed.*

61 (12*d*). Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Frederick A. Martell, postmaster at L'Ardoise, Richmond County, N.S., and of the evidence taken and of the reports of investigation held by H. P. Duchemin, in regard to the same, and a detailed statement of the expenses of such investigation; and a copy of all papers relating to the appointment of his successor. Presented 16th April, 1913.—*Mr. Kyte.....Not printed.*

61 (12*e*). Return to an Order of the House of the 11th December, 1912, for a copy of all representations, statements and complaints as to political activity made against John A. Macdonald, postmaster at McArras Brook, Antigonish County, and of all correspondence relating to the charges made against him and of the report of Commissioner Duchemin on said charges. Presented 16th April, 1913.—*Mr. Chisholm (Antigonish).....Not printed*

61 (12*f*). Return to an Address to His Royal Highness the Governor General of the 7th December, 1911, for a copy of all papers, correspondence and orders in council in connection with and relating to the dismissal from office of public officials from each of the departments of government since the 1st day of October last past, including both Inside and Outside Service. Presented 18th April, 1913.—*Mr. Carvell.....Not printed.*

61 (12*g*). Return to an Address to His Royal Highness the Governor General of the 3rd March, 1913, for a copy of all papers, documents, correspondence, evidence, order in council, &c., relative to the dismissal of Edward Doucett, sub-collector of customs, Digby County, N.S. Presented 21st April, 1913.—*Mr. McLean (Halifax).*
Not printed.

61 (12*h*). Return to an Address to His Royal Highness the Governor General of the 3rd March, 1913, for a copy of all papers, documents, correspondence, evidence, orders in council, &c., relative to the dismissal of Mr. LeBlanc, sub-collector of customs, Church Point, Digby County, N.S. Presented 21st April, 1913.—*Mr. McLean (Halifax).*
Not printed

CONTENTS OF VOLUME 27—*Continued.*

61 (12*i*). Return to an Order of the House of the 19th March, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of John C. Bourinot, chief customs officer at Port Hawkesbury, Inverness County, Nova Scotia, and of the evidence taken and report of investigation held by Mr. H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of such investigation. Presented 21st April, 1913.—*Mr. Chisholm (Inverness).*
Not printed.

61 (12*j*). Return to an Order of the House of the 31st March, 1913, for a copy of all charges, evidence, correspondence, letters and telegrams in the Department of Railways and Canals since the 21st day of September, 1911, relating to the dismissal of Alexander E. Morrison, Point Tupper, N.S., from the service of the Intercolonial railway, and of all recommendations for the appointment of his successor. Presented 21st April, 1913.—*Mr. Kyte*.. .. ..*Not printed*

61 (12*k*). Return to an Order of the House of the 3rd February, 1913, for a copy of all letters, telegrams, reports and other papers and documents received from the officers of the Canadian Brotherhood of Railway Employees, by the Department of Labour, or of the Department of Railways and Canals, between the 1st day of January, 1912, and the 25th day of January, 1913, relating to investigations and dismissals of employees for political partizanship, and of the replies thereto. Presented 22nd April, 1913.—*Mr. Sinclair*.....*Not printed.*

61 (12*l*). Return to an Order of the House of the 31st March, 1913, for a copy of all complaints and charges against James Falconer, of Newcastle, County of Northumberland, New Brunswick, as correspondent of the *Labour Gazette* at Newcastle, and of all letters, telegrams and other correspondence relating in any way to his dismissal and the appointment of a successor. Presented 22nd April, 1913.—*Mr. Loggie*..*Not printed.*

61 (12*m*). Return to an Order of the House of the 19th March, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of John B. Chisholm, lightkeeper at Port Hastings, Inverness County, Nova Scotia, and the evidence taken and report of investigation held by Mr. H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of such investigation. Presented 24th April, 1913.—*Mr. Chisholm (Inverness)*.....*Not printed*

61 (12*n*). Return to an Order of the House of the 7th April, 1913, for a copy of all correspondence, telegrams, charges and other documents, relating to the dismissal of Epiphane Nadeau, immigration agent at St. Leonard, Victoria County, N.B. Presented 25th April, 1913.—*Mr. Michaud*.. .. ..*Not printed.*

61 (12*o*). Return to an Order of the House of the 31st March, 1913, for a copy of all charges, correspondence, letters, telegrams, and other documents relative to the dismissal of D. J. Morrison, boatman in the customs service at Big Bras D'or, North Cape Breton and Victoria, N.S., and of the evidence taken and of reports of the investigation held by H. P. Duchemin, in regard to the same, with a detailed statement of expenses of such investigation. Presented 25th April, 1913.—*Mr. McKenzie.*
Not printed

61 (12*p*). Return to an Order of the House of the 31st March, 1913, for a copy of all charges, correspondence, letters, telegrams, and other documents relative to the dismissal of Rod McLeod, boatman in the customs service at Big Bras D'or, North Cape Breton and Victoria, N.S., and of the evidence taken and of reports of the investigation held by H. P. Duchemin, in regard to the same, with a detailed statement of expenses of such investigation. Presented 25th April, 1913.—*Mr. McKenzie.*
Not printed.

CONTENTS OF VOLUME 27—*Continued.*

61 (12*q*). Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of D. McLachlin, postmaster at Marble Mountain, Inverness County, Nova Scotia, and of the evidence taken and report of investigation held by H. P. Duchemin in regard to the same; also a detailed statement of the expenses of such investigation. Presented 25th April, 1913.—*Mr. Chisholm (Inverness).. .. ..Not printed.*

61 (12*r*). Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Ahram LeBlanc, postmaster at West Arichat, Richmond County, N.S., and of the evidence taken and reports of investigation held by H. P. Duchemin in regard to the same and a detailed statement of the expenses of such investigation, and a copy of all papers relating to the appointment of his successor. Presented 25th April. 1913.—*Mr. Kyte..... .....Not printed.*

61 (12*s*). Return to an Order of the House of the 11th December, 1912, for a copy of all correspondence, letters, telegrams and other documents relating to the dismissal of Charles J. Lafford, postmaster at Grand Grove, Richmond County, N.S., and of all evidence taken and report of investigation held by H. P. Duchemin in regard to the same; also a detailed statement of the expenses of such investigation. Presented 25th April, 1913.—*Mr. Kyte..... .....Not printed*

61 (12*t*). Return to an Order of the House of the 11th Decemher, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of W. S. Lawrence, postmaster at Margrave Harbour, Inverness County, Nova Scotia, and of the evidence taken and report of investigation held by H. P. Duchemin. in regard to the same; also a detailed statement of the expenses of such investigation. Presented 25th April, 1913.—*Mr Chisholm (Inverness).. .. ..Not printed.*

61 (12*u*). Return to an Order of the House of the 11th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of John K. McDonald, postmaster at Whycocomagh, Inverness County, Nova Scotia, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of such investigation. Presented 25th April, 1913.—*Mr. Chisholm (Inverness).....Not printed*

61 (12*v*). Return to an Order of the House of the 31st March. 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Captain P. J. Wilcox, from the customs office at Louisburg, Cape Breton South, Nova Scotia, and of evidence taken and reports of investigations held by H. P. Duchemin, in regard to the same. Presented 29th April, 1913.—*Mr. Carroll.*

Not printed

61 (12*w*). Return to an Order of the House of the 31st March, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of M. J. McKennon, from the customs office at Glace Bay, Cape Breton South, Nova Scotia, and of evidence taken and reports of investigation held by H. P. Duchemin, in regard to the same. Presented 29th April, 1913.—*Mr. Carvell.....Not printed*

61 (12*x*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of Captain John Arsenault, telegraph line repairer at Alder Point, Cape Breton, in the riding of North Cape Breton and Victoria, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to same, and a detailed statement of the expenses of such investigation. Presented 29th April, 1913.—*Mr. McKenzie.*

Not printed.

CONTENTS OF VOLUME 27—*Continued.*

G1 (12*g*). Return to an Order of the House of the 9th December, 1912, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Mrs. John Arsenault, telegraph operator at Alder Point, N.S., in the riding of North Cape Breton and Victoria. Presented 2nd May, 1913.—*Mr. McKenzie.*
Not printed

61 (12*h*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters, petitions, telegrams, complaints, evidence, reports and other papers and documents in the possession of the Department of Railways and Canals or any department of the government, relating to the dismissal of A. J. Wilkinson, at Mulgrave, N.S. and if there was an investigation, the names of all witnesses examined and a detailed statement of the expenses of such investigation. Presented 2nd May, 1913.—*Mr. Sinclair*.....*Not printed.*

61 (13*a*). Charges made against Mr. H. A. Bayfield, superintendent of dredging, British Columbia.—(*Senate*).....*Not printed.*

61 (13*b*). Return to an Order of the House of the 31st March, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of H. G. McKay, lighthouse keeper at Bird Island, Big Bras D'or, North Cape Breton and Victoria, and of the evidence taken, and of reports of the investigation held by H. P. Duchemin, in regard to the same, with a detailed statement of expenses of such investigation. Presented 5th May, 1913.—*Mr. McKenzie*.....*Not printed.*

61 (13*c*). Return to an Order of the House of the 10th March, 1913, for a copy of all reports, charges, and correspondence in the office of the Department of Marine and Fisheries relating to charges of political partizanship against Michael O'Brien, lightkeeper at Bear Island, Richmond County, N.S., and of the instructions issued to H. P. Duchemin, commissioner, to investigate the same together with the Commissioner's report and finding thereon, and his expenses of holding such investigations. Presented 7th May, 1913.—*Mr. Kyte*.....*Not printed.*

61 (13*d*). Return to an Order of the House of the 17th February, 1913, for a copy of all correspondence, letters, telegrams, reports, recommendations and other documents bearing on or having relation to the dismissal of J. H. Leduc, as medical port officer of the port of Three Rivers, P.Q. Presented 7th May, 1913.—*Mr. Bureau*..*Not printed.*

61 (13*e*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Patrick Shea, postmaster at Tompkinsville, Guysborough County, N.S. Presented 7th May, 1913.—*Mr. Sinclair*.....*Not printed.*

61 (13*f*). Return to an Order of the House of the 29th January, 1913, for a copy of all complaints and charges made against Elias Rawding, postmaster at Clementsport Annapolis County, N.S., and of all letters, petitions, telegrams, and other correspondence relating in any way to his dismissal and the appointment of a successor. Presented 7th May, 1913.—*Mr. Sinclair*.....*Not printed.*

61 (13*g*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Charles McLean, postmaster at Strathlorne, Inverness County, Nova Scotia Presented 7th May, 1913.—*Mr. Chisholm* (*Inverness*).....*Not printed.*

61 (13*h*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Angus R. McDonald, postmaster at Broad Cove Chapel, Inverness County, Nova Scotia. Presented 7th May, 1913.—*Mr. Chisholm* (*Inverness*)..*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (13*i*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of John McPhail, postmaster at Scotsville, Inverness County, Nova Scotia. Presented 7th May, 1913.—*Mr. Chisholm (Inverness)*.....*Not printed.*

61 (13*j*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters, telegrams, complaints, petitions or other documents of any kind received by the government, or any member or official thereof, relating to the conduct of J. Morgan, one time postmaster of the village of Ailsa Craig, Ontario, as such, and relating to an investigation into said conduct. Presented 7th May, 1913.—*Mr. Ross.*
Not printed

61 (13*k*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Roderick McLean, postmaster at Kenlock, Inverness County, Nova Scotia. Presented 8th May, 1913.—*Mr. Chisholm (Inverness)*.....*Not printed*

61 (13*l*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Allan Gillis, postmaster at Gillisdale, South West Margaree, Inverness County, Nova Scotia. Presented 8th May, 1913.—*Mr. Chisholm (Inverness)*.
Not printed.

61 (13*m*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of David Shaw, postmaster at Marsh Brook, North East Margaree, Inverness County, Nova Scotia. Presented 8th May, 1913.—*Mr. Chisholm (Inverness)*.
Not printed

61 (13*n*). Return to an Order of the House of the 29th January, 1913, for a copy of all papers concerning the investigation and dismissal of Helen Joubert, postmistress at Sayabec, Quebec. Presented 8th May, 1913.—*Mr. Lemieux*.....*Not printed.*

61 (13*o*). Return to an Order of the House of the 29th January, 1913, for a copy of all correspondence, letters, and telegrams between the Honourable Postmaster General or the Post Office Department, and any person or persons, relative to the dismissal or the request therefor of D. A. Redmond, until recently postmaster at Brinston, Ontario. Presented 8th May, 1913.—*Mr. Graham*.....*Not printed.*

61 (13*p*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Dan. McEachern, postmaster at McEachern's Mills, Broad Cove Chapel, Inverness County, Nova Scotia. Presented 8th May, 1913.—*Mr. Chisholm (Inverness)*.
Not printed.

61 (13*q*). Return to an Order of the House of the 3rd February, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of Daniel Duulop, postmaster at New Campbellton, riding of North Cape Breton and Victoria, N.S., and of the evidence taken and reports of the investigation held by H. P. Duchemin, in regard to same, with a detailed statement of expense of such investigation. Presented 8th May, 1913.—*Mr. McKenzie*.....*Not printed.*

61 (13*r*). Return to an Order of the House of the 15th January, 1913, for a copy of all papers, letters, telegrams, evidence and other documents regarding the dismissal of Arthur Armstrong, postmaster at Greenfield, Carleton County, N.B. Presented 8th May, 1913.—*Mr. Carvell*.....*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (13*s*). Return to an Order of the House of the 3rd February, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relative to the dismissal of Alex. Matheson, postmaster at Boulardarie Centre, north riding Cape Breton and Victoria. Presented 8th May, 1913.—*Mr. McKenzie*.....*Not printed.*

61 (13*t*). Return to an Order of the House of the 15th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Arthur Talbot, late postmaster at Robertsville, County of Megantic, Province of Quebec. Presented 8th May, 1913.—*Mr. Pacaud*.....*Not printed.*

61 (13*u*). Dismissal of N. C. Lyster, late postmaster at Lloydminster, Sask.—(*Senate*). *Not printed.*

61 (13*v*). Return to an Order of the House of the 2nd April, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of Mrs. Maggie Cameron, postmistress at Achosnach, Inverness County, Nova Scotia. Presented 9th May, 1913.—*Mr. Chisholm (Inverness)*.. .. .. ..*Not printed.*

61 (13*w*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of David Fraser, postmaster at North East Margaree, Inverness County, Nova Scotia. Presented 9th May, 1913.—*Mr. Chisholm (Inverness)*.. .. .. ..*Not printed.*

61 (13*x*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal and retention of W. Stayley Porter, postmaster, Port Maitland, Yarmouth County, N.S., and of the evidence taken and report of investigation held by Charles Lane, in regard to the same; also a detailed statement of expenses of such investigation. Presented 9th May, 1913.—*Mr. Law*.....*Not printed*

61 (13*y*). Return to an Order of the House of the 29th January, 1913, for a copy of all charges, telegrams and other documents relating to the dismissal of Alex. McQueen, postmaster at Kowstoke, Inverness County, Nova Scotia, and of the evidence taken and report of investigation held by H. P. Duchemin, in regard to the same; also a detailed statement of the expenses of such investigation. Presented 9th May, 1913.—*Mr. Chisholm (Inverness)* .. ..*Not printed.*

61 (13*z*). Return to an Order of the House of the 3rd February, 1913, for a return showing the number of employees of the Department of Public Works who have been dismissed in the County of Berthier since the 21st September, 1911, giving the names of the said employees; if an inquiry was held in each case; on whose recommendation, in each case, these dismissals were made; the names of those appointed successors to these persons and on whose recommendation. Presented 12th May, 1913.—*Mr. Beland* *Not printed.*

61 (14*a*). Return to an Order of the House of the 10th February, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents in connection with the dismissal and retention of Jesse L. Morton, postmaster at Lower Argyle, N.S., and of the evidence taken and report of the investigation held by Mr. Lane, in regard to the same, also a detailed statement of the expenses of such investigation. Presented 20th May, 1913.—*Mr. Law*.....*Not printed*

61 (14*b*). Return to an Order of the House of the 10th February, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents in connection with the dismissal of Mrs. M. C. Gaudet, postmistress at West Pubnico, Yarmouth County, N.S., and of the evidence taken and report of the investigation held by Mr. Lane, in regard to same, and also a detailed statement of the expenses of such investigation Presented 20th May, 1913.—*Mr. Law*.....*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (14*c*). Return to an Order of the House of the 28th April, 1913, for a copy of all charges, correspondence, telegrams, and other documents relative to the dismissal of John P. McKinnon, section foreman on the Intercolonial railway at Shubenacadie, in the riding of North Cape Breton and Victoria, N.S. Presented 20th May, 1913.—*Mr. McKenzie*.....*Not printed.*

61 (14*d*). Return to an Order of the House of the 15th January, 1913, for a copy of all papers, letters, telegrams, evidence and other documents regarding the dismissal of Mary A. Bohan, as postmistress at Bath, Carleton County, N.B. Presented 21st May, 1913.—*Mr. Carvell*.....*Not printed.*

61 (14*e*). Return to an Order of the House of the 15th January, 1913, for a copy of all papers, letters, telegrams, evidence and other documents regarding the dismissal of Elward Lafferty, postmaster at Benton, Carleton County, N.B. Presented 21st May, 1913.—*Mr. Carvell* .....*Not printed.*

61 (14*f*). Return to an Order of the House of the 15th January, 1913, for a copy of all papers, letters, telegrams, evidence and other documents regarding the dismissal of Dennis McGaffigan, postmaster at Florenceville, Carleton County, N.B. Presented 21st May, 1913.—*Mr. Carvell*.....*Not printed.*

61 (14*g*). Return to an Order of the House of the 27th January, 1913, for a copy of all correspondence and documents bearing upon any change made or asked for in the employees of the Department of Marine and Fisheries in the County of Bonaventure between 5th December, 1912, up to date. Presented 27th May, 1913.—*Mr. Marcil (Bonaventure)*.. .. ..*Not printed.*

61 (14*h*). Return to an Order of the House of the 15th January, 1913, for a copy of all charges, correspondence, letters, telegrams and other documents relating to the dismissal of J. A. McKenzie, postmaster at Ashfield, Inverness County, N.S. Presented 2nd June, 1913.—*Mr. Chisholm (Inverness)*.. .. ..*Not printed.*

61 (14*i*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters, petitions, telegrams, complaints, reports and other papers and documents in the possession of the Post Office Department, or any department of the government, relating to the dismissal of James Bowles, postmaster at Alder River, N.S., and if there was an investigation, the names of all the witnesses examined, a copy of the evidence, and a detailed statement of the expense of such investigation. Presented 2nd June, 1913.—*Mr. Sinclair*.....*Not printed.*

61 (14*j*). Return to an Order of the House of the 21st April, 1913, for a copy of all correspondence, complaints, reports, recommendations, petitions, certificates and other documents relating to the dismissal of Mr. Edmund Lacroix, as postmaster of the Parish of St. Joseph du Lac, County of Two Mountains, and the appointment of Rodrique Larocque, of the same place as postmaster. Presented 2nd June, 1913.—*Mr. Ethier*.....*Not printed*

61 (14*k*). Return to an Order of the House of the 26th May, 1913, for a copy of all papers, letters, documents, reports and inquiry, relating to the lighthouse keeper of the Parish of Repentigny, County of L'Assomption. Presented 3rd June, 1913.—Mr. *Seguin*.....*Not printed.*

61 (14*l*). Return to an Order of the House of the 16th April, 1913, for a copy of all papers, documents, evidence, reports, &c., relating to the dismissal of B. C. Kanock, late shipping master at Lunenburg, N.S. Presented 4th June, 1913.—*Mr. McLean (Halifax)*. *Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

61 (14*m*). Return to an Order of the House of the 3rd March, 1913, for a copy of all complaints, accusations, correspondence, petitions and telegrams, respectiug the dismissal of Ulric Thibaudeau, agent for pilots at Quebec, and of all documents respecting the appointment of his successor, such as petitions, letters of recommendation, &c., and of the evidence and report made after the inquiry held by the inquiring commissioner; aud also a detailed statement of the expenses caused by this inquiry. Presented 4th June, 1913.—*Mr. Delisle*.....*Not printed.*

61 (14*n*). Supplementary return to an Order of the House of the 20th January, 1913, for a return showing the names of all officials of the Marine and Fisheries Department who have been dismissed or removed in the Couuty of Pictou, the reasons of the same, the evidence taken at any investigation held in regard to them, and the reports of said investigations, the names of their successors, and a copy of all letters, charges, complaiuts and recommendations from any person or persons in regard to the said removals or dismissals, or in regard to the appointment of their successors. Presented 4th June, 1913.—*Mr. Macdonald*.....*Not printed.*

61 (14*o*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters, petitions, telegrams, complaints, evidence, reports aud other papers and documents in the possession of the Post Office Department, or auy department of the government relating to the dismissal of Captain Freeman Myers, postmaster at Cole Harbour, Guysborough Couuty, N.S., and if there was an investigation, the names of all witnesses examined, a copy of the evidence, and a detailed statement of the expenses of such investigation. Presented 4th June, 1913.—*Mr. St. Clair.*
Not printed

61 (14*p*). Return to an Order of the House of the 4th December, 1912, for a return showing all public officers removed by the present government in the district of St. James, Montreal, together with the names and duties of such persons, the reasons of their dismissal, the nature of the complaints brought against them, and a copy of all correspondence relating thereto, and of reports of inquiries in the cases where such have been held. Presented 4th June, 1913.—*Mr. Lapointe (Montreal)*.....*Not printed*

61 (14*q*). Return to an Address to His Royal Highness the Governor General of the 4th December, 1912, for a return showing all the employees of the Dominion government in the constituency of Edmonton, dismissed between 10th of October, 1911, and 21st of November, 1912, the salary being paid to such employee at the time of his dismissal, together with a copy of all correspondence, recommendations to council, orders in council, and all other papers or documents in any way connected with such dismissal: Presented 4th Juue, 1913.—*Mr. Oliver*.....*Not printed.*

61 (14*r*). Return to an Order of the House of the 4th December, 1912, for a return showing the names of all officials in the district of Sunbury and Queens, who have been dismissed or removed from office since September, 1911, the reason for such dismissal or removal, the evidence taken at any investigation held in regard to them, the reports upon such investigations, the name of any successor appointed in place of dismissed officials, aud a copy of all letters, charges, complaints and recommendations in regard to the said removals or dismissals, or in regard to the appointment of their successors. Presented 4th June, 1913.—*Mr. McLean (Sunbury)*.....*Not printed.*

61 (14*s*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters, petitions, telegrams, complaints, evidence, reports and other papers and documents in the possession of the Department of Marine and Fisheries, or any department of the government relating to the dismissal of Levi Muuroe, harbour master at

CONTENTS OF VOLUME 27—*Continued.*

White Head, N.S., and if there was an investigation, the names of all witnesses examiued, a copy of the evidence, and a detailed statement of the expenses of such investigation. Presented 4th June, 1913.—*Mr. Sinclair*.....*Not printed.*

61 (14*t*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters petitions, telegrams, complaints, evidence, reports and other papers and documents in the possession of the Post Office Department, or any department of the government, relating to the dismissal of Stanford Langley, postmaster at Isaac Harbour North, N.S., and if there was an investigation the names of all witnesses examined, a copy of the evidence, and a detailed statement of the expenses of such investigation. Presented 5th June, 1913.—*Mr. Sinclair*.....*Not printed.*

61 (14*u*). Return to an Order of the House of the 24th February, 1913, for a copy of all letters, telegrams, correspondence, charges, evidence, reports, and other documents relating to the dismissal of Hugh R. McAdam as postmaster at Arisaig, N.S., and the appointment of Reverend Daniel L. Macdonald as his successor. Presented 5th June 1913.—*Mr. Chisholm (Antigonish)*.....*Not printed.*

61 (14*v*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters, petitions, telegrams, complaints, evidence, reports and other papers and documents in the possession of the Post Office Department, or any department of the government, relating to the proposed dismissal of J. J. McNeil, at Grant's Lake, N.S., and if there was an investigation, the names of the witnesses examined and a detailed statement of the expenses of such investigation. Presented 5th June, 1913.—*Mr. Sinclair*.....*Not printed*

61 (14*w*). Return to an Order of the House of the 29th January, 1913, for a copy of all letters, petitions, telegrams, complaints, evidence, reports and other papers and documents in the possession of the Department of Railways and Canals, or any department of the government, relating to the dismissal of Alex. McInnis, car inspector of the Intercolonial railway at Mulgrave, N.S., and if there was an investigation, the names of all witnesses examined, a copy of the evidence, and a detailed statement of the expenses of such investigation. Presented 6th June, 1913.—*Mr. Sinclair*..*Not printed.*

61 (14*x*). Return to an Order of the House of the 28th April, 1913, for a copy of all charges, correspondence, telegrams, and other documents relative to the dismissal of Archibald McDonald, bridge tender on the Intercolonial railway at Grand Narrows, Iona, riding of North Cape Breton and Victoria, N.S. Presented 6th June, 1913.—*Mr. McKenzie*.....*Not printed.*

61 (14*y*). Names of all officials dismissed in Shelburne and Queens from 1st December, 1896. —(*Senate*).....*Not printed.*

62. Return to an Order of the House of the 4th December, 1912, for a return showing the number of all contracts cancelled in the County of Bonaventure since the 1st of October, 1911; the names of the contractors, the prices paid to them, the reasons for the cancellation in each case; and a copy of any investigations and reports had into the causes of such cancellations, the names of the new contractors and the prices paid to them in each case. Presented 14th January, 1913.—*Mr. Marcil (Bonaventure)*. *Not printed.*

62*a*. Return to an Order of the House of the 5th December, 1912, for a return showing the number of rural mail delivery routes that have been established in Canada since the 1st January, 1912, in each province and county, respectively. Presented 14th January, 1913.—*Mr. Lemieux*.....*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

62*b*. Return to an Order of the House of the 9th December, 1912, for a copy of all correspondence, letters, telegrams, complaints and other documents relating to the cancelling of the contract for conveying His Majesty's mails, entered into on the 1st day of January, 1912, between the Honourable Postmaster General and Mr. J. C. Beeman, of Guthrie, County of Missisquoi; together with the reason for the cancellation of this contract, the price paid to Mr. Beeman, the name of the present contractor and the price paid to him. Presented by Hon. Mr. Pelletier.—*Mr. Kay*.....*Not printed.*

62*c*. Return to an Order of the House of the 11th March, 1912, for a copy of all letters, requests, memorandums, tenders and other documents in the possession of the Post Office Department relating to the calling for tenders and the granting of the contract now in force for the carrying of the mail between Sorel and Ste. Victoire, County of Richelieu. Presented 20th January, 1913.—*Mr. Cardin*.....*Not printed.*

62*d*. Return to an Order of the House of the 4th December, 1912, for a copy of all papers, letters, telegrams, tenders, bonds, agreements, contracts and other documents in the possession of the Post Office Department relating to the letting of the contract for carrying the mails between Heatherton and Guysborough, in the year 1912; and also relating to any temporary agreement entered into prior to the date of letting such contract. Presented 21st January, 1913.—*Mr. Sinclair*.....*Not printed*

62*e*. Return to an Order of the House of the 29th January, 1913, for a copy of all letters and other documents relating to the establishment of a rural mail service between Saltsprings and West River Station, in the County of Pictou, in the year 1912. Presented 17th February, 1913.—*Mr. Macdonald*.....*Not printed.*

62*f*. Return to an Order of the House of the 29th January, 1913, for a copy of all letters, and other documents relating to the establishment of a rural mail delivery service between Merigonish Station, County of Pictou, and Arisaig, in the County of Antigonish, in the year 1912. Presented 17th February, 1913.—*Mr. Macdonald.*

Not printed

62*g*. Return to an Order of the House of the 29th January, 1913, for a copy of all correspondence, letters, telegrams and reports regarding the termination of H. D. Decoste's contract for carrying the mails between Linwood Station and Linwood post office and the making of a new contract with D. Delorey, from the 1st January, 1913. Presented 28th February, 1913.—*Mr. Chisholm (Antigonish)*.....*Not printed.*

62*h*. Return to an Order of the House of the 4th December, 1912, for a copy of all correspondence, complaints, recommendations, telegrams and reports bearing on the railway mail service in Bonaventure County from October, 1911, up to date, and on the appointment and dismissal of officers in such connection, with the names, residences, salaries and duties, as well as of all documents bearing on the suspension of the railway mail service during the period mentioned, as well as a copy of all documents referring to agreements made to meet such a contingency during the coming winter. Presented 25th March, 1913.—*Mr. Marcil (Bonaventure)*.....*Not printed.*

62*i*. Return to an Order of the House of the 9th December, 1912, for a copy of all tenders received and the contracts entered into for the carrying of the mails between St. Andrew and Beauley, County of Antigonish, and of all letters, telegrams and correspondence on file in the Post Office Department containing any recommendation or advice regarding the awarding of such contract, or in any way referring thereto. Presented 26th March, 1913.—*Mr. Chisholm (Antigonish)*.....*Not printed.*

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62*j*. Return to an Order of the House of the 3rd February, 1913, for a return showing what changes, if any, have been made in the contracts for the carrying of the mails in the County of Berthier, since the 21st September, 1911; in what parishes, on what date, and for what reason; to whom have the new contracts been granted, and if a tender was asked for in each case. Presented 14th April, 1913.—*Mr. Béland.*
Not printed

62*k*. Return to an Order of the House of the 29th January, 1913, for a copy of all letters, petitions, telegrams, bonds, reports and other papers and documents in the possession of the Post Office Department, or any department of the government, relating to the letting of the mail contract between Guysborough and Charlos Cove, County of Guysborough, N.S., during the year 1912. Presented 28th April, 1913.—*Mr. Sinclair.*
Not printed.

62*l*. Return to an Order of the House of the 14th April, 1913, showing the names of the various railway mail clerks employed, respectively, on the Montreal and Quebec divisions and the date of the appointment and residence of each. Presented 7th May, 1913.—*Mr. Bureau* .....*Not printed.*

62*m*. Return to an Order of the House of the 9th April, 1913, for a copy of the contract entered into by the Post Office Department with the Ontario Equipment Company of Ottawa relating to the purchase of locks for mail bags. Presented 7th May, 1913.—*Mr. Carvell* .....*Not printed.*

62*n*. Return to an Order of the House of the 7th April, 1913, for a copy of all correspondence, telegrams, &c., exchanged between the Honourable the Postmaster General and Dr. Faucher, of Quebec, concerning the purchase of a certain patented lock for mail bags. Presented 7th May, 1913.—*Mr. Lapointe (Kamouraska)*.. .. .. ..*Not printed.*

62*o*. Return to an Order of the House of the 7th April, 1913, for a copy of all correspondence, telegrams, &c., exchanged between the Honourable the Postmaster General and Mr. Aimé Dion, advocate of Quebec, concerning the purchase of a certain patented lock for mail bags. Presented 7th May, 1913.—*Mr. Verville*.....*Not printed.*

62*p*. Return to an Order of the House of the 29th January, 1913, for a copy of all letters, petitions, telegrams, complaints, reports, bonds of indemnity, and all other papers and documents in the possession of the Post Office Department, or any department of the government, relating to the contract for carrying the mails between Linwood or some point of the Intercolonial railway, County of Antigonish, N.S., and Grosvenor, County of Guysborough, N.S. Presented 9th May, 1913.—*Mr. Sinclair*....*Not printed.*

62*q*. Return to an Order of the House of the 24th April, 1913, for a return showing the full names of the mail carriers in the County of Vaudreuil and Soulanges; between what place they perform the service; the distance between each of these places; the amount of each carrier's contract, and the amount the government paid for the carriage of the mail in these different places before September, 1911. Presented 16th May, 1913.—*Mr. Boyer*.....*Not printed.*

62*r*. Return to an Order of the House of the 7th May, 1913, for a return showing the number of post offices in Yarmouth County, Nova Scotia, not served with daily mail, giving the names and the number of times per week served. Presented 20th May, 1913. —*Mr. Law*..... ..... *Not printed.*

62*s*. Return to an Address to His Excellency the Administrator of the 7th April, 1913, for a copy of all orders in council, reports of experts and contracts, in connection with

CONTENTS OF VOLUME 27—*Continued.*

the different purchases of rural mail delivery boxes made by the Post Office Department since 1908, until 1st January, 1912. Presented 21st May, 1913.—*Mr. Lemieux.* *Not printed.*

62*t*. Return to an Order of the House of the 12th May, 1913, for a return giving the names of the post offices and of the postmasters in the Counties of Soulanges and Vaudreuil. Presented 21st May, 1913.—*Mr. Boyer*.....*Not printed.*

62*u*. Return to an Order of the House of the 5th December, 1912, for a copy of all letters, telegrams, petitions and other documents relating to the establishment of rural mail delivery routes in the County of Pictou since the 1st October, 1911, with a statement of all routes applied for, of routes established and of those refused, and the reason for their refusal. Presented 2nd June, 1913.—*Mr. Macdonald*.....*Not printed.*

62*v*. Return to an Order of the House of the 31st March, 1913, for a copy of all correspondence concerning the purchase of new locks for mail bags by the Post Office Department from the Ontario Equipment Company. Presented 4th June, 1913.—*Mr. Carvell.* *Not printed.*

62*w*. Return to an Order of the House of the 17th February, 1913, for a copy of all correspondence, letters, telegrams, memoranda, tenders, bonds and all other documents relative to the contract for the carrying of the mail between the post office and Canadian Pacific Railway station at Three Rivers and vice versa, since the eleventh day of October, 1911, to date. Presented 4th June, 1913.—*Mr. Tobin*.....*Not printed.*

62*x*. Return to an Order of the House of the 21st April, 1913, for a copy of all correspondence, telegrams, complaints, affidavits, reports, recommendations, requests, certificates, contracts and other documents relating to the cancelled contract of M. E. Bougie, for carrying the mails between the post office and railway station at Bromptonville, Quebec. Presented 4th June, 1913.—*Mr. Bureau*.....*Not printed.*

63. Return to an Order of the House of the 4th December, 1912, for a return showing all the new post offices opened in the County of Bonaventure, since October, 1911, up to date, and a copy of the correspondence in connection therewith, together with the names of such post offices and postmasters, and the location of such offices; and also a copy of all papers asking for such offices. Presented 14th January, 1913.—*Mr. Marcil (Bonaventure)*..... .....*Not printed*

64. Return to an Order of the House of the 9th December, 1912, for a copy of all petitions, correspondence, memoranda, recommendations and other papers or documents in the possession of the Department of Marine and Fisheries relating to the proposals to supply medicine or medical attendance free, or otherwise, to Canadian boat fishermen. Presented 14th January, 1913.—*Mr. Sinclair*.....*Not printed*

65. Return to an Order of the House of the 4th December, 1912, for a copy of all correspondence, petitions, complaints, memoranda, reports and investigations regarding the service performed by the steamer *Canada*, owned by the Inter-Provincial Navigation Company of Fraserville, Quebec, since October, 1911, up to date, and also of all documents bearing on the present contract with the Department of Trade and Commerce, or the renewal or extension thereof. Presented 14th January, 1913.—*Mr. Marcil (Bonaventure)*..... .....*Not printed*

66. Return to an Order of the House of the 9th December, 1912, for a copy of all papers, documents, telegrams, letters, &c., relating to the matter of the establishment of a lobster hatchery at Spry Bay, Halifax County, N.S. Presented 14th January, 1913. —*Mr. Maclean (Halifax)*..... .....*Not printed.*

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67. Return to an Order of the House of the 9th December, 1912, for a copy of all papers, documents, telegrams, &c., between the Department of Trade and Commerce and any company, person or persons, relative to the continuance and payment of a subsidy towards a steamship service between St. John, N.B., and Bear River, N.S., for the fiscal year 1912, and performed during the fiscal year 1911. Presented 17th January 1913.—*Mr. Maclean (Halifax)*.....*Not printed.*

67*a*. Return to an Order of the House of the 4th December, 1912, for a copy of all papers, documents, memoranda, letters, telegrams and documents bearing on a request for a subsidy for a steam service between Bonaventure, Quebec, or any other part of Bonaventure County and Bathurst, New Brunswick, or any other part of Gloucester County, New Brunswick, and between New Richmond, Quebec, and Dalhousie, New Brunswick, and between Carleton and Miguasha, Quebec, and Dalhousie, New Brunswick, or Campbellton, New Brunswick, or both, as well as a copy of all replies made for such subsidies and this since October, 1911, to date. Presented 14th January, 1913.—*Mr. Marcil (Bonaventure)*.....*Not printed.*

67*b*. Return to an Address to His Royal Highness the Governor General of the 9th December, 1912, for a copy of all advertisements, tenders, contracts, orders in council memoranda, papers, letters and correspondence in any way relating to a subsidized steamship service between Canadian ports and any ports of the British West Indies, or any proposed improvement or extension of such steamship service since 1st November, 1911 to the present time. Presented 15th January, 1913.....*Not printed.*

67*c*. Return to an Order of the House of the 4th December, 1912, for a copy of all reports made by officials of the Department of Railways and Canals on the Quebec and Oriental railway, and the Atlantic, Quebec and Western railways, together with a statement of the subsidies paid such railways since October, 1911, up to date, and a copy of all correspondence in that connection. Presented 17th January, 1913.—*Mr Marcil (Bonaventure)*.....*Not printed*

67*d*. Return to an Order of the House of the 4th December, 1912, for a copy of all correspondence between the Minister of Railways or any other member of the government and any person regarding the acquisition by the government of Canada of the Quebec Oriental railway, formerly the Atlantic and Lake Superior railway, and the Atlantic, Quebec and Western railway, or both. Presented 27th January, 1913. *Mr. Marcil (Bonaventure)*.....*Not printed.*

67*e*. Return to an Order of the House of the 29th January, 1913, for a copy of the report made to the Minister of Railways and Canals by the party of government engineers who inspected the Quebec and Saguenay railway during December, 1912, January, 1913. Presented 27th February, 1913.—*Mr. Lemieux*.....*Not printed.*

67*f*. Return to an Order of the House of the 17th February, 1913, for a copy of all reports made by any engineers or accountants to the Minister of Railways and Canals on the usefulness of the Atlantic, Quebec and Western railway and the Quebec Oriental railway, to the Intercolonial railway as branch lines or feeders. Presented 27th February, 1913.—*Mr. Marcil (Bonaventure)*.....*Not printed.*

67*g*. Return to an Address to His Royal Highness the Governor General of the 9th December, 1912, for a copy of all papers, documents, petitions, orders in Council, memoranda, correspondence, &c., by and between the government of Canada or any member thereof, and the government of the province of British Columbia, or any member thereof, since 1st May, 1912, relating to the subject to an increase of the provincial subsidy to the said province. Presented 16th April, 1913.—*Mr. Maclean (Halifax).*

Printed for sessional papers.

CONTENTS OF VOLUME 27—*Continued.*

67*h*. Return to an Address to His Royal Highness the Governor General of the 20th January, 1913, for a copy of all documents and memorials of the government of British Columbia presenting claims for additional provincial subsidies, and of all correspondence and orders in council on the same. Presented 16th April, 1913.—*Sir Wilfrid Laurier*..... .....*Printed for sessional papers.*

67*i*. Copy of agreement made with the several provinces as to the expenditure of the subsidies granted under the Agricultural Aid Act, and statement showing the purposes for which said subsidies are to be expended. Presented 6th June, 1913, by Hon. Mr Burrell.... ....*Not printed*

68. Copies of general orders promulgated to the militia for the period between 2nd November, 1911, and 5th Novmber, 1911. Preseuted by Hon. Mr. Hughes, 14th January, 1913. *Not printed*

69. Return to an Address to His Excellency the Right Honourable Sir Charles Fitzpatrick, P.C., &c., administrator, of the 31st March, 1913, for a copy of all papers, documents, petitions, letters, telegrams, orders in council and other papers and documents in possession of the Department of Customs, relating to the duty payable on twine used for fishing purposes, and especially relating to the construction placed upon item 682 of the Customs Tariff. Presented 23rd May, 1913.—*Mr. Sinclair*.....*Not printed.*

70. Return to an Order of the House of the 30th November, 1912, for a return showing:—

1. The date when the preseut Canadian Pure Food Act, uow known as the Adulteration Act, R.S.C., was enacted.

2. What foods, beverages or drugs have standards of strength and purity under the Act been fixed, and what are the dates when such standards become operative.

3. What foods, beverages or drugs have standards of strength and purity been prepared and recommended from time to time by the chief analyst, which have not been put in force, and why were such standards not put in force.

4. How many cases of adulteration together with cases which show standards of quality below those required by the Adulteration Act, have been ascertained by the Dominion analyst since the said Act came into operation.

5. In how many of such cases did prosecutions under the Act or under the Criminal Code follow, and in how many cases were convictions secnred. Presented 14th January, 1913.—*Mr. McDonnell*..... .....*Not printed.*

71. Return to an Order of the House of the 4th December, 1912, for a copy of all correspondence, negotiations, propesals in writing and other papers and documents in the possession of the government, or any departmeut thereof, relating to reciprocity in trade with the United States, bearing date between the 1st day of January, 1890, and the 31st day of December, 1891. Presented 14th January, 1913.—*Mr. Sinclair.*
Not printed

72. Return to an Order of the House of the 4th December, 1912, for a copy of all letters, telegrams, &c., exchanged between the member for Bellechasse County and the Minister of Agriculture and the Postmaster General, concerning the appointment of an additional physician at the quarantine station of Grosse Ile. Presented 14th January, 1913.—*Mr. Lemieux*..... .....*Not printed.*

72*a*. Return to an Order of the House of the 10th December, 1912, for a copy of all correspondence, documents, recommendations and reports concerning the appointment of Doctor Pomminville, to the position of surgeon of the St. Vincent de Paul penitentiary, replacing Doctor A. Allaire. Presented 24th Jauuary, 1913.—*Mr. Wilson (Laval)*..... ....*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

72*b*. Return to an Order of the House of the 10th December, 1912, for a copy of all letters, telegrams, correspondence and other documents relating to the appointment of Charles W. Hatfield, fishery officer on the Tusket River, Yarmouth County, N.S. Presented 27th January, 1913.—*Mr. Law*.....*Not printed.*

72*c*. Return to an Order of the House of the 10th December, 1912, for a copy of all correspondence, letters, requests, telegrams and other documents relating to the appointment of Louis Nadeau as postmaster at Ste. Christine, County of Bagot. Presented 4th February, 1913.—*Mr. Marcil*.....*Not printed.*

72*d*. Return to an Order of the House of the 29th January, 1913, for a copy of all orders letters, telegrams and other documents in connection with the appointment of Lt.-Col. Warburton, as administrative medical officer at the Charlottetown camp in 1912, and of all letters and telegrams asking for a change in the said appointment, and of all orders and other documents relating to his being superseded, and to the appointment of his junior, Lt.-Col. Jenkins, in his place. Presented 13th February, 1913.—*Mr. Macdonald*.....*Not printed.*

72*e*. Return to an Order of the House of the 27th January, 1913, for a copy of all documents, letters, correspondence, recommendations, reports, &c., relating to the appointment of Mr. J. Begin as manager of the experimental farm at Ste. Anne de la Pocatière. Presented 13th February, 1913.—*Mr. Lapointe (Kamouraska)*....*Not printed.*

72*f*. Return to an Order of the House of the 29th January, 1913, for a copy of all correspondence exchanged between Dr. Marcotte, M. Lavallée, M.P., the Honourable the Postmaster General and the Minister of Agriculture, concerning the appointment of an additional medical officer at Grosse Isle quarantine station. Presented 19th February, 1913.—*Mr. Lemieux*.....*Not printed.*

72*g*. Return to an Order of the House of the 3rd March, 1913, for a copy of all letters, telegrams, recommendations and other papers in connection with the appointment of John Macdonald as Inspector of Inland Revenue for the Maritime Provinces, and of all letters, telegrams, applications, recommendations and other papers received from any other person or persons relative to the applications of other persons for the position. Presented 17th March, 1913.—*Mr. Macdonald*.....*Not printed.*

72*h*. Retnrn to an Order of the House of the 17th February, 1913, for a copy of all letters, petitions, telegrams, recommendations and other papers and documents, in the possession of the Department of Marine and Fisheries, or any department of the government, relating to the appointment of F. W. Kelley, M.D., as port physician at Bridgewater, N.S. Presented 18th March, 1913.—*Mr. Law*.....*Not printed*

72*i*. Return to an Address to His Royal Highness the Governor General of the 4th December, 1912, for a return showing all appointments to office under the Dominion government in the constituency of Edmonton from 10th October, 1911, to 21st November, 1912, with a statement of the salaries in each case, together with a copy of all correspondence, recommendation to council, orders in council, and all other papers or documents in any way connected with such appointments. Presented 28th March, 1913.—*Mr. Oliver*.....*Not printed.*

72*j*. Return to an Order of the House of the 4th December, 1912, for a copy of all correspondence, recommendations, reports, memoranda and other documents bearing on the appointment of a general foreman, or other permanent or temporary officials, of the Department of Public Works in the County of Bonaventure since October, 1911, up to date, with the names, residences, duties and salaries of such appointees. Presented 2nd May, 1913.—*Mr. Marcil (Bonaventure)*.....*Not printed.*

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72*k*. Appointment of Mr. McCloskie as postmaster at Wankau, British Columbia.—(*Senate*) *Not printed.*

73. Return to an Address to His Royal Highness the Governor General of the 9th December, 1912, for a return showing all changes made in the Customs Tariff of Canada by order in council since the close of last session of parliament. Presented 14th January, 1913.....*Not printed.*

74. Return to an Order of the House of the 9th December, 1912, for a return showing the quantity and value of molasses of cane, as defined in tariff item No. 137a, imported into Canada for the fiscal year ending 31st March, 1912, from each island of the British West Indies, which are parties to the Canada-West India Trade Agreement. Presented 14th January, 1913.—*Mr. Maclean (Halifax)*.....*Not printed.*

75. Letter of the Honourable F. D. Monk, M.P., to the Right Honourable the Prime Minister, resigning his position as Minister of Public Works, and the letter of the Prime Minister in acknowledgment thereof. Presented by Hon. Mr. Borden, 14th January, 1913.....*Not printed.*

75*a*. Return to an Order of the House of the 26th May, 1913, for a copy of all letters, reports, documents and all other communications relating to the appointment of Colonel Crowe as Commandant of the Royal Military College and to his resignation of said position, or to the extension of his term of service or to the termination thereof, and of all papers or letters passing between the minister and Colonel Crowe, relative to his resignation or the failnre to extend his term of service. Presented 3rd June, 1913.—*Mr. Macdonald*.....*Not printed*

75*b*. Return to an Order of the House of the 26th May, 1913, for a copy of all letters reports, complaints and other communications and documents which passed between General McKenzie and the Minister of Militia or his department, previous to, and which led np to the resignation of General McKenzie; and also a copy of said resignation, and the reply of the minister thereto, and of any and all communications had with the War Office thereto, and of all other papers and documents in connection therewith. Presented 4th June, 1913.—*Mr. Macdonald*.....*Not printed.*

76. Return to an Order of the House of the 4th December, 1912, for a copy of all papers, letters, telegrams, complaints and reports, bearing on the delay in the payment of census enumerators in the County of Bonaventnre, in connection with the last census, together with the names, residences, amounts, and dates of payment. Presented 15th January, 1913.—*Mr. Marcil (Bonaventure)*.....*Not printed.*

77. Report of departmental commission on the official statistics of Canada. Presented 15th January, 1913 .....*Printed for distribution only.*

78. Return to an Order of the House of the 18th March, 1912, for a copy of all correspondence in the possession of the Postmaster General respecting the change of name of Broderick post office in the Province of Saskatchewan, to St. Aldwyn. Presented 15th January, 1913.....*Not printed.*

78*a*. Return to an Order of the House of the 30th November, 1911, for a copy of all papers, telegrams, letters, &c., between the Postmaster General and any other person respecting the closing or removal of the present post office at Spry Bay, Halifax County. Presented 20th January, 1913.—*Mr. Maclean (Halifax)*.....*Not printed.*

79. Report of the commissioner Dominion Police Force, for the year 1912. Presented by Hon. Mr. Foster, 15th January, 1913.....*Not printed.*

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80. Return to an Order of the House of the 9th December, 1912, for a copy of all correspondence, complaints, reports and all documents relating to the cancelling of lease No. 18778, consented to by the Honourable Minister of Railways and Canals, to Aurile Lebœuf, on the 12th December, 1910.—Presented 16th January, 1913.—*Mr. Papineau.*
Not printed

81. Return to an Address to His Royal Highness the Governor General of the 4th December, 1912, for a copy of all orders in council passed since 1st October, A.D. 1911, relating to the Board of Management of the Government Railways of Canada, or of any other member thereof, or in any way affecting the same, or any official of the Intercolonial Railway, as regards the duties to be performed or the powers to be exercised by the said Board or any member thereof, or by any such official, together with a copy of all recommendations, letters, applications, instructions, or other correspondence, in any manner relating thereto or having regard to the said orders in council as to the management of the Intercolonial railway. Presented 17th January, 1913.—*Mr. Emmerson*.....*Not printed*

81*a*. Return to an Address to His Royal Highness the Governor General of the 4th December, 1912, for a copy of a certain Order in Council issued during the current year by which certain official reports formerly made to Board of Management of the Intercolonial Railway have been ordered in future to be made to Mr. F. P. Brady. Presented 17th January, 1913.—*Mr. Sinclair*.....*Not printed.*

82. Return to an Order of the House of the 5th December, 1912, for a copy of all papers, including surveys, tenders, and every other record, or document in the possession of the Department of Railways and Canals or any other department of the government relating to the building of a line of railway from Estmere, County of Victoria, Province of Nova Scotia, to the town of Baddeck in the same county. Presented 17th January, 1913.—*Mr. McKenzie*.....*Not printed.*

83. Return to an Address to His Royal Highness the Governor General of the 9th December, 1912, for a copy of all documents, papers, tenders, contracts, orders in council and correspondence in connection with the supply of castings for and the purchase of scrap iron from the eastern division of the Intercolonial Railway since 1st May, 1912. Presented 17th January, 1913.—*Mr. Maclean (Halifax)*.....*Not printed.*

83*a*. Return to an Order of the House of the 9th December, 1912, for a return showing the names of the employees on the dining cars of the Intercolonial Railway and the nature of their employment; and also of the employees on the Pullman cars of the Intercolonial Railway and the nature of their employment. Presented 17th January, 1913.—*Mr. Boulay*.....*Not printed.*

83*b*. Return to an Order of the House of the 9th December, 1912, for a copy of all papers documents, telegrams, letters, &c., relating to a strike of temporary employees of the Intercolonial Railway at Halifax, in August, 1912. Presented 27th January, 1913.—*Mr. Mclean (Halifax)*.....*Not printed.*

83*c*. Return to an Order of the House of the 10th December, 1912, for a copy of all evidence plans, reports, correspondence, &c., respecting an inquiry held concerning an accident on the Intercolonial Railway at St. André de Kamouraska on 7th October, 1912, caused by train No. 33, the maritime express going west. Presented 27th January, 1913.—*Mr. Lapointe (Kamouraska)*.....*Not printed.*

83*d*. Return to an Order of the House, of the 29th January, 1913, for a copy of the evidence taken at the inquiry held in the month of November, 1912, by Mr. MacDonald

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superintendent of the Intercolonial at Lévis, in reference to Alfred Langnay, an employee of the Intercolonial at St. Charles, County of Bellechasse. Presented 27th February, 1913.—*Mr. Lapointe (Kamouraska)*.....*Not printed.*

83*e*. Return to an Order of the House of the 19th February, 1913, for a copy of all telegrams, letters, petitions, reports of engineers, plans, surveys, and other documents in the possession of the Department of Railways and Canals, and having been received since 1st January, 1912, relating to the construction of a branch line of the Intercolonial Railway into Guysborough County. Presented 18th March, 1913.—*Mr. Sinclair*.....*Not printed.*

83*f*. Return to an Order of the House of the 24th February, 1913, for a copy of all petitions, resolutions, letters, telegrams and correspondence, relating to free or reduced transportation of hay over the Intercolonial Railway for the farmers of Antigonish County, Nova Scotia, and also of the evidence taken and report made as to the shortage of hay in that and other of the eastern counties of Nova Scotia. Presented 18th March, 1913.—*Mr. Chisholm (Antigonish)*.....*Not printed.*

83*g*. Return to an Order of the House of the 29th January, 1913, for a copy of all letters telegrams, tenders, acceptances of tenders, cancellation of tenders and other papers and documents in the possession of the Department of Railways and Canals, or any department of the government, bearing date after 1st July, 1912, relating to the supply of ice for the use of the Intercolonial Railway at Mulgrave, N.S. Presented 18th March, 1913.—*Mr. Sinclair*.....*Not printed.*

83*h*. Return to an Order of the House of the 12th February, 1913, for a copy of all letters correspondence, petitions and other documents, on file in the Department of Railways and Canals, or in the office of the Intercolonial Railway at Moncton, relating or in any way appertaining to the new public wharf at Sackville, N.B., and the necessity of establishing in the interest of the traffic of the Intercolonial Railway, and of the shipping and trade facilities of Sackville, and of the commerce of communities adjacent thereto, rail connections between the said wharf and the main line of the said railways at Sackville station; also of all letters and other communications received by the chairman or vice-chairman of the Government Railways Managing Board, or by any official of the said railway, relating in any manner to the said subject, received by them or any of them during the years 1911, 1912 and 1913. Presented 19th March, 1913.—*Mr. Emmerson*.....*Not printed*

83*i*. Return to Order of the House of the 19th March, 1913, for a return showing who the tenderers were, and the amount of each tender for the supply of castings for the Intercolonial Railway during the present year. Presented 28th March, 1913.—*Mr. Macdonald*.....*Not printed.*

83*j*. Return to an Order of the House of the 19th March, 1913, for a return showing how many kegs of nails were purchased in 1912 for the Intercolonial Railway; the prices paid therefor in each case; whether tenders were invited in the case of each purchase and, if so, who the respective tenderers were and the prices submitted; to whom were the contracts awarded in each case. Presented 28th March, 1913.—*Mr. Murphy.*
Not printed.

83*k*. Return to an Order of the House of the 19th March, 1913, for a return showing the amounts received by the Intercolonial Railway for freight and passengers respectively for each of the twelve months of the calendar years 1910, 1911 and 1912, at the following stations:—Montreal, Halifax, St. John, Sydney, Truro, Moncton, New Glasgow

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and Amherst; also, the total receipts of the said railway for freight and passengers respectively during each of the said years. Presented 28th March, 1913.—*Mr. Rhodes.*
Not printed.

83*l*. Return to an Order of the House of the 20th January, 1913, for a copy of all letters correspondence, telegrams, representations, requests and reports on file in the Department of Railways and Canals, or in the offices of the Intercolonial Railway at Moncton, or among the records of the Government Railways Managing Board, or in the office of the assistant chairman of the Government Railways Managing Board, relating to or in any way connected with the water supply system at Dorchester station on the Intercolonial railway, or relating to the absence of and the total failure to provide a supply of water for drinking or other purposes at that station, or in connection with the dwelling of the station agent in the Station House; and also of all correspondence, letters, requests, recommendations and reports relating to the alleged necessity of additional clerical or other help or assistance at the station. Presented 21st April, 1913.—*Mr. Emmerson*.....*Not printed.*

83*m*. Return to an Order of the House of the 12th February, 1913, for a copy of all correspondence, letters, telegrams, reports and other papers on file in the Department of Railways and Canals, or in the offices of the Intercolonial Railway at Moncton, relating to M. L. Tracy, an employee of the mechanical department of the Intercolonial during the years 1899 and 1900, and of all letters and correspondence relating to the case of the said M. L. Tracy, passing between the then Minister of Railways and Canals and any of the officials of the railway, during those years; also a copy of the letters of D. Pottinger, then general manager, the late James E. Price, then general superintendent, and the late M. Jarvis, then a divisional superintendent of said railway, relating to the same subject during the said period of 1899 and 1900. Presented 21st April, 1913.—*Mr. Emmerson*.....*Not printed.*

83*n*. Return to an Order of the House of the 3rd March, 1913, for a statement of all amounts collected by the Intercolonial Railway for freight on hay carried from Amherst and other stations on the Intercolonial, County of Cumberland, to Antigonish, N.S., and consigned to C. Edgar Whidden or C. B. Whidden & Son, in the month of January last and February instant, and by whom such freight was paid; also a copy of all way bills and bills of lading for the same. Presented 21st April, 1913. —*Mr. Chisholm* (*Antigonish*).....*Not printed.*

83*o*. Return to an Order of the House of the 3rd February, 1913, for a copy of all letters petitions, telegrams, complaints, communications, reports and other papers and documents, received since the 1st day of October, 1911, by and now in the possession of the Department of Railways and Canals, the Government Railway Managing Board or any official of the Intercolonial Railway or of the Prince Edward Island railway, relating to or in any manner appertaining to an application for, or a proposed reduction of the working hours for the Intercolonial railway employees at Moncton, or at any other point of the Intercolonial railway or the Prince Edward Island railway. Presented 21st April, 1913.—*Mr. Emmerson*.....*Not printed.*

83*p*. Return to an Order of the House of the 24th February, 1913, for a copy of all complaints, requirements, requisitions, petitions, and correspondence of all kinds made by the Sydney, N.S., Board of Trade, or by the citizens of the city of Sydney, or any of them, having reference to better and increased facilities on the Intercolonial Railway on the Sydney division. Presented 21st April, 1913.—*Mr. Carroll.*
Not printed.

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83*q*. Return to an Order of the House of the 31st March, 1913, for a copy of all letters, papers and other documents relating to the claim for damages for the death of the young son of Thomas Hoare, who was killed at a crossing of the Intercolonial Railway in the town of Stellarton in the summer of 1912, and of all petitions, letters, and other papers asking for the placing of gates or other protection at said crossing. Presented 1st April, 1913.—*Mr. Macdonald*.....*Not printed*

83*r*. Return to an Order of the House of the 14th April, 1913, for a copy of all correspondence exchanged between the Department of Railways and Canals at Moncton and the same department at Campbellton, on the subject of the collision which occurred at St. Moise, during the month of February, 1913, between the trains of E. Smith and the regular train No. 99, omitting from it the inquiry held in the matter. Presented 29th April, 1913.—*Mr. Boulay*.....*Not printed.*

83*s*. Return to an Order of the House of the 7th April, 1913, for a return showing the names, residences and occupations of all the employees of the Intercolonial Railway who have been dismissed in the County of Rimouski since the 21st September, 1911. Presented 29th April, 1913.—*Mr. Lapointe (Kamouraska)*.....*Not printed.*

83*t*. Certified copy of a report of the Privy Council of the 5th May, 1913, covering the appointment of Frederick Passmore Gutelius, as general manager of Government Railways. Presented by Hon. Mr. Cochrane, 7th May, 1913... .. .. ..*Not printed.*

83*u*. Return to an Order of the House of the 31st March, 1913, for a copy of all letters, memorials, petitions, correspondence, reports and other documents in the Department of the Postmaster General, or on file therein, relating or in any wise appertaining to the inauguration or establishing of railway mail facilities between Moncton, N.B., westward over the Intercolonial Railway towards St. John, in the morning, so as to furnish, among other things, opportunities for the transmission of newspapers and other mail matter, along said railway, to make morning connection with the railway mail facilities afforded by the railway from Salisbury, Westmorland County, N.B., running into Albert County, N.B.; and also relating to the establishment of railway mail facilities on each week day evening between Moncton eastward over the said railway by train known as number 84, running between Moncton, N.B., and Springhill Junction, Nova Scotia, thus affording the direct mail connection for newspapers and other mail matter each evening from Moncton to Shediac, Memramcook, Dorchester, Sackville, Amherst, and intermediate points east of Moncton; together with a statement showing what, if any, such railway mail facilities, either by locked bag or otherwise, were established or furnished over either of the said routes, and stating the respective dates when the same were so established or furnished generally, or in relation to any one of the newspapers published in Moncton, either in the morning or in the evening. Presented 12th May, 1913.—*Mr. Emmerson*.....*Not printed.*

83*v*. Return showing whether any contract has been made for the construction or supply of cars of any kind to the Intercolonial Railway since 1st January, 1913, and if so, to whom the contract was awarded; the number of cars, kind or class, and the price to be paid; whether any tenders were called for previous to awarding said contract, and if so, who the tenderers were, the amount of the tender in each case, and if tenders were called for by private request or public advertisement. Presented 21st May, 1913. —*Mr. Macdonald*.....*Not printed.*

83*w*. Return to an Order of the House of the 28th April, 1913, for a return showing all amounts collected by the Intercolonial Railway for freight on hay shipped from Amherst and other stations on the Intercolonial, in the County of Cumberland, to Antigonish and other stations in the County of Antigonish, during the months of

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January, February and March last; the name of the consigners and of the consignees, the amount of freight paid on each shipment and by whom paid; also a copy of all way-bills and bills of lading for same. Presented 6th June, 1913.—*Mr. Chisholm (Antigonish)*.....*Not printed.*

84. Return to an Address to His Royal Highness the Governor General of the 9th December, 1912, for a copy of all papers, documents, memoranda, orders in council, letters and correspondence, relating in any way to the closing of the Canadian Immigration Office at Boston, U.S.A., in 1911, and its subsequent re-establishment. Presented 17th January, 1913.—*Mr. McLean (Halifax)*.....*Not printed*

85. Copies of despatches dated 11th December, 1912, which have been addressed to the Governors General of the Commonwealth of Australia and the Union of South Africa and the Governors of New Zealand and Newfoundland, on the subject of representation of the self-governing Dominions on the Committee of Imperial Defence. Presented by Hon. Mr. Borden, 17th January, 1913.....*Not printed.*

86. Reports in connection with the Tides and Currents of Northumberland Strait.—(*Senate*).....*Not printed.*

87. Archives Branch, *re* transferring of from Department of Agriculture to Secretary of State.—(*Senate*).....*Not printed.*

88. Commission appointed to investigate Indian reserves of British Columbia.—(*Senate*). *Not printed.*

89. Insurance rates between Canadian Atlantic ports, and ports in the United Kingdom.—(*Senate*) .....*Printed for distribution and sessional papers.*

90. Report of departmental commission relating to official statistics of Canada.—(*Senate*). *Printed for distribution only.*

91. Copy of the Sixth Joint Report of the Commissioners for the Demarcation of the Meridian of the 141st degree of west longitude. Presented by Hon. Mr. Roche, 21st January, 1913.....*Not printed.*

92. Return to an Order of the House of the 9th December, 1912, for a copy of all papers, documents, petitions, memoranda, correspondence, &c., with the Government of British Columbia or any member thereof, with the fishery officers of the Marine and Fisheries Department resident in said province, with salmon canneries in said province, and with any company, person or persons, relating to the prohibition of the export of sockeye salmon from the said province of British Columbia since 15th October, 1911. Presented 20th January, 1913.—*Mr. Maclean (Halifax)*....*Not printed.*

93. Return to an Order of the House of the 20th March, 1912, for a copy of all correspondence and memoranda on the subject of cable rates, exchanged between the Canadian Post Office Department and the British Post Office Department. Presented 20th January, 1913.—*Mr. Lemieux*.....*Not printed.*

94. Return to an Address to His Royal Highness the Governor General of the 9th December, 1912, for a copy of all papers, documents, letters, &c., between the Government of Canada and the Commonwealth of Australia for the past twelve months relative to the matter of preferential tariff arrangements between the said two countries. Presented 21st January, 1913.—*Mr. Maclean (Halifax)*..*Printed for sessional papers only.*

95. Report of Mr. Olivar Asselin on an investigation of Belgian and French emigration to Canada. Presented by Hon. Mr. Roche, 21st January, 1913.

Printed for distribution and sessional papers.

CONTENTS OF VOLUME 27—*Continued.*

95a. Return to an Order of the House of the 4th December, 1912, for a copy of all complaints, letters, papers, reports, and of all documents bearing on the investigation held at Port Daniel West, Quebec, into the conduct of Edward Dea, as overseer or guardian of the lobster hatchery at that place. Presented 22nd January, 1913.—*Mr. Marcil* ....*Not printed.*

95b. Report of R. A. Pringle, Esq., K.C., in relation to the investigation of the wreck of the steamer *Mayflower*, on the 12th November, 1912. Presented by Hon. Mr. Hazen, 6th February, 1913..... .....*Not printed.*

95c. Return to an Address to His Royal Highness the Governor General of the 29th January, 1913, for a copy of the report of the commission appointed to investigate complaints against the United Shoe Machinery Company, together with the order in council appointing the commission, the complaints upon which the order was issued and all action, if any, taken by the government on report of commission, by order in council or otherwise. Presented 11th Febrnary, 1913.—*Sir Wilfrid Laurier.*
Not printed

95d. Return to an Order of the House of the 20th January, 1913, for a copy of all evidence, letters, telegrams and other documents in connection with the investigation into the stranding of the D. G. steamer *Earl Grey* at Toney River, County of Pictou, in the spring of 1912; of the reports of the commissioner investigating the same, and of all correspondence, telegrams and documents in connection therewith, and of any departmental action in connection therewith. Presented 18th March, 1913.—*Mr. Macdonald.*
Not printed

95e. Return to an Order of the House of the 27th January, 1913, for a copy of all letters, papers, evidence and other documents in connection with the investigation into the collision between the steamship *City of Sydney* and the tug boat *Douglas H. Thomas*, in Sydney Harhour, 13th November, 1912, and of the findings and reports of the commissioner holding the investigation in regard to the same. Presented 2nd April, 1913.—*Mr. Macdonald*.....*Not printed.*

96. Report of the Second International Moral Education Congress held at the Hague, 22nd to 27th of August, 1912, and as related thereto, on moral instruction in the Canadian public schools, &c., by Mr. J. A. M. Aikins, who was appointed by the government to represent Canada at that Congress. Presented by Hon. Mr. Borden, 21st January, 1913.....*Printed for distribution only.*

97. Return to an Order of the House of the 4th December, 1912, for a copy of all pay-lists, letters, documents, letters and other papers in connection with the expenditures at Carihoo Island in the County of Pictou. Presented 21st January, 1913.—*Mr Macdonald* ....*Not printed.*

98. Return to an Order of the House of the 22nd January, 1913, for a copy of all correspondence, letters and telegrams between the Minister of Marine and Fisheries, or any officer of his department, and J. A. Gillies, K.C., Sydney, relating to the purchase from John B. Nicholson, of a site for a salmon hatchery at Snidlope Lake, Richmond County, N.S., and also of all accounts, charges and vouchers received from the said J. A. Gillies, for services in connection therewith and the payments made to the said J. A. Gillies in respect of the same. Presented 7th February, 1913.—*Mr. Kyte.*
Not printed.

CONTENTS OF VOLUME 27—*Continued.*

99. Return to an Order of the House of the 9th Decemher, 1912, for a copy of all papers, documents and correspondence, between the Department of Puhlic Works and any person or persons relating to the placing of ohstructions in the waters of South West Cove, Lunenburg County, N.S. Presented 24th January, 1913.—*Mr. Maclean (Halifax)*..... .....*Not printed.*

100. Return to an Order of the House of the 4th Decemher, 1912, for a copy of all pay-lists, letters, documents, telegrams and other papers in connection with the expenditures at Skinner's Cove in the County of Pictou. Presented 24th January, 1913.—*Mr. Macdonald* ....*Not printed.*

101. Return to an Address to His Royal Highness the Governor General of the 22nd January, 1912, for a copy of all correspondence between the government of Canada and the government of the Province of Ontario, with regard to the extension of the boundaries of the said province. Presented 28th January, 1913.—*Sir Wilfrid Laurier.* *Not printed.*

102. Return to an Order of the House of the 4th Decemher, 1912, for a copy of all correspondence, reports, and documents, hearing on the claim of C. R. Scoles, of New Carlisle, Quebec, to a halance of subsidy voted to the Atlantic and Lake Superior railway, since October, 1911, to date. Presented 24th January, 1913.—*Mr. Marcil.* *Not printed.*

103. Return to an Order of the House of the 4th Decemher, 1912, for a copy of all correspondence, letters, telegrams, reports and other documents concerning an alleged defalcation in the accounts of Joseph J. Melanson, clerk in the customs office at Bathurst, County of Gloucester, which caused an inquiry to be held on the 23rd of October last hy the Provincial Inspector of Customs, with the name of the accuser. Presented 24th January, 1913.—*Mr. Turgeon*.....*Not printed.*

104. Return to an Order of the House of the 9th December, 1912, for a copy of all papers, letters and telegrams in the custody of the Department of Railways and Canals, or any other department of the government, hetween the 1st day of Septemher, 1874, and the 1st day of September, 1879, relating to the acquisition or expropriation of lands at St. Peters, N.S., for canal purposes, and relating to the appointment of valuators to apprise the value of such lands; the instructions to such valnators, the report or reports of such valuators, the area of lands taken, and the price paid for same; and also the amount paid each valuator for his services. Presented 27th January, 1913.—*Mr. Kyte*.....*Not printed.*

105. Return to an Order of the House of the 4th December, 1912, for a copy of all the different freight tariffs in force on the line of railway from Matapedia, Quebec, to New Carlisle, Quebec, and from New Carlisle, to Gascons, Quebec, and vice versa, and of any requests that have heen received in regard to the change in the same; and also a copy of any requests, petitions, letters, or other documents complaining of the said tariffs. Presented 27th January, 1913.—*Mr. Marcil (Bonaventure).* *Not printed.*

105*a*. Return to an Order of the House of the 10th December, 1912, for a copy of the different freight tariffs in force on the line of railway from Sunny Brae to Ferrona Junction, on the Intercolonial Railway, and of any requests that have been received in regard to the change in the same, and also a copy of any requests, petitions, letters or other documents complaining of said tariff. Presented 27th January, 1913. —*Mr. Sinclair*..... .....*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

106. Return to an Order of the House of the 5th Decemher, 1912, for a copy of the original instructions, iucluding maps, specifications, profiles, &c., furnished the engineers on the eastern division of the Transcontinental railway between Winnipeg aud Quebec hy the chief eugineer of the Trauscontinental Commission, and approved by the Grand Trunk Pacific Railway Company. Also of all instructions, including specifications and profiles, issued hy the chief engineer of the Transcontinental Commission or by the chairman. siuce 31st October, 1911, which in any way vary, amend, or depart from the original instructions ahove mentioned. Also, of all correspondence between the Minister of Railways or any official of his department aud the chairman of the Transcontinental Commission, or the chief engineer, concerniug the departure from the original instructions, either as to the grades, curves and hridges or other permanent structures. Also a copy of all correspondeuce between the Minister of Railways or any member of the government and any official of the Grand Trunk Pacific Railway Company referring to chauge of origiual instructions as regards grades, curves or permanent structures on the said line between Winnipeg and Quebec; and also of all correspondence between the chairman of the Transcontinental Commission or the chief engineer and any official of the Grand Trunk Pacific Railway Company, or any member of its engineering staff, coucerning the proposed change of grades, curves, or other permauent structures on the line of the Transcontinental hetween Winnipeg and the City of Quebec. Presented 30th January, 1913—*Mr. Graham.*

Not printed.

106*a*. Return to an Order of the House of the 7th May, 1913, for a copy of a letter, dated 24th Septemher, 1904, written hy Chief Eugineer Lumsden of the Transcontinental Commission to Chairman Wade of the same hody, in which the former recommended to the latter certain grades on the Transcoutinental railway. Presented 15th May, 1913.—*Mr. Graham*.....*Not printed.*

107. Return to an Order of the House of the 20th January, 1913, for a copy of all papers in connection with a claim of L. A. Sauvé to certain huildings at La Pointe des Cascades, on the Soulanges canal, and of all correspondence on the same. Presented 30th Jauuary, 1913.—*Sir Wilfrid Laurier*.....*Not printed.*

108. Return to an Order of the House of the 5th Decemher, 1912, for a copy of the contract entered into hetween the Department of Railways and Canals and W. H. Weller for St. Peters canal improvements, and for a copy of all correspondence between the contractor or any other person, firm or corporatiou and the Honourahle Minister of Railways and Canals relating to the dumping of material removed hy the contractor. Presented 30th Jauuary, 1913.—*Mr. Kyte*.....*Not printed.*

108*a*. Return to an Order of the House of the 27th Jauuary, 1913, for a copy of all correspondence between the Department of Railways and Canals and C. D. Sargent, C.E., and hetween C. D. Sargent, C.E., and H. G. Stanton, Superintending Eugineer of the St. Peters Canal, or hetween W. H. Weller, contractor for the St. Peters canal improvements, and either or all of said parties relative to work doue by the contractor outside of his contract, and the specifications thereof, and also a copy of all correspondence, letters and telegrams between the Department of Railways and Canals or C. D. Sargent, C.E., and any other person, in regard to the same; and of all accouuts and vouchers rendered hy the coutractor to the government of such work, and the payment made hy the government to the contractor, specifying whether the same is paid for in full or otherwise. Presented 21st April, 1913.—*Mr. Kyte.*

Not printed.

108*b*. Return to an Order of the House of the 19th March, 1913, for a copy of the accouuts of personal expenses paid to Mr. St. Amour, Superintendent of the Soulanges Canal,

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since he entered upon his duties.—Also return to an Order of the House of the 2nd April, 1913, for a copy of all accounts for personal expenses paid by the government to Mr. St. Amour, Superintendent of the Soulanges Canal, since the date of his appointment. Presented 29th April, 1913.—*Mr. Boyer*.....*Not printed.*

109. Return to an Order of the House of the 10th December, 1912, for a copy of all correspondence, letters, telegrams, petitions and other documents received since the 1st day of January, 1912, asking that the line of railway known as the Vale Road, should be taken over by the Intercolonial Railway. Presented 30th January, 1913.—*Mr. Macdonald*.....*Not printed.*

110. Return to an Order of the House of the 27th January, 1913, for a copy of all correspondence in connection with the issuing of letters patent to the Quebec Railway, Light, Heat and Power Company, Limited, and also said letters patent. Presented 30th January, 1913.—*Mr. Lemieux*.....*Not printed.*

111. Return to an Order of the House of the 9th December, 1912, for a copy of all papers, documents, correspondence, &c., between the Department of Trade and Commerce and Mr. Donnelly, late Canadian Trade Commissioner in Mexico, relating to the closing of the office of such trade commissioner in Mexico. Presented 3rd February, 1913.—*Mr. Maclean (Halifax)*.....*Not printed.*

112. Return called for by Section 88 of Chapter 62, Revised Statutes of Canada, requiring that the Minister of the Interior shall lay before parliament, each year, a return of liquor brought from any place out of Canada into the territories by special permission in writing of the Commissioner of the Northwest Territories. Presented by Hon. Mr. Roche, 3rd February, 1913.....*Not printed.*

113. Return to an Order of the House of the 22nd January, 1913, for a copy of all letters, telegrams and other papers and documents, relating to the resignation of Lt.-Col. W. F. Moore, 20th Regiment, Halton Rifles, and also of the resignation and the reply thereto. Presented 6th February, 1913.—*Mr. Macdonald*.....*Not printed.*

114. Return to an Order of the House of the 20th January, 1913, for a copy of all letters, papers, telegrams and other documents in connection with the strike of firemen and other men employed on the D.G.S. *Earl Grey*, in the year 1912 and 1913. Presented 11th February, 1913.—*Mr. Macdonald*.....*Not printed.*

115. Return to an Order of the House of the 27th March, 1912, for a copy of all papers, letters and telegrams relating to the applications for, or the granting of, a lease of False Cove Flats, Vancouver, B.C. Presented 11th February, 1913.—*Mr. Macdonald.* *Not printed.*

116. Return to an Order of the House of the 27th January, 1913, for a copy of all correspondence and other papers in connection with a proposed guarantee of bonds to the Quebec and Saguenay railway. Presented 11th February, 1913.—*Mr. Lemieux*.....*Not printed.*

116*a*. Return to an Order of the House of the 9th April, 1913, for a copy of all documents, including petitions, memorials, letters and telegrams, addressed to the government, or any of its members, urging it to take over and incorporate into the Canadian government railway system, the Quebec and Oriental Railway and the Atlantic, Quebec and Western Railway, with a copy of all the answers thereto. Presented 20th May, 1913.—*Mr. Marcil (Bonaventure)*.....*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

116*b*. Return to an Address to His Royal Highness the Governor General of the 11th December, 1912, for a copy of all orders in council in connection with the construction of a line of railway from St. John to Grand Falls in the Province of New Brunswick, or any portion thereof and also of all plans and profiles filed with the Department of Railways and Canals by the St. John and Quebec Railway Company, and of all correspondence between the Department of Railways and Canals or any official thereof and with the said company or the Government of the Province of New Brunswick, or any official thereof, with reference to the curves, grades or general specifications of the said railway or any portion thereof. Presented 20th May, 1913.—*Mr. Carvell.*

Not printed

116*c*. Return to an Order of the House of the 28th April, 1913, for a copy of all memorials, petitions, letters, and other documents submitted to the Board of Railway Commissioners from 1st January, 1913, to date, by any party whatsoever regarding the service of the Quebec and Oriental Railway and the Atlantic, Quebec and Western Railway, as to freight, passengers and express matters, with a copy of all orders and rulings issued by such Board and of all correspondence in connection therewith. Presented 20th May, 1913.—*Mr. Marcil (Bonaventure)*.....*Not printed.*

117. Return to an Address to His Royal Highness the Governor General of the 5th December, 1912, for a return showing the number of appeals made to the Governor in Council during the twelve months preceding 25th November, 1912, against orders of the Board of Railway Commissioners, the particulars of each appeal, and the decision rendered by the Governor in Council in each case. Presented 11th February, 1913.—*Mr. Graham* .....*Printed for sessional papers only.*

118. Return to an Address to His Royal Highness the Governor General of the 22nd January, 1913, for a copy of all orders in council and of all correspondence relating to the extension of facilities for obtaining information useful to Canadian Trade and Commerce in connection with the British Consular Service. Presented 11th February, 1913.—*Mr. Ames*..... .....*Not printed.*

119. Return to an Order of the House of the 24th January, 1913, for a return showing all the employees of the different departments at Ottawa, and also in the nine provinces and territories of Canada, and other places outside of Canada, in the inside and outside service, who have left their employment since the 1st October, 1911, up to the 10th January, 1912, inclusively, with their names, Christian names, age, nationality, employment and salaries respectively; the date of their appointment; the date of their leaving; their salaries, the time of their appointment and at leaving; the reasons of their leaving; and if replaced or not; the names, Christian name, age, nationality, employment and salary of those who have replaced them; and in the case of dismissals, a list of the persons who asked for their dismissals; and in the case of these replacing them, a list of the persons who recommended their successors Presented 11th February, 1913.—*Mr. Wilson (Laval)*.....*Not printed.*

119*a*. Supplementary return to an Order of the House of the 24th January, 1912, for a return showing all the employees of the different departments at Ottawa, and also in the nine provinces and territories of Canada, and other places ontside of Canada, in the inside and outside service, who have left their employment since the 1st October, 1911, up to the 10th January, 1912, inclusively, with their names, Christian names, age, nationality, employment and salaries respectively; the date of their appointment; the date of their leaving; their salaries at the time of their appointment and at leaving; the reasons of their leaving; and if replaced or not; the names, Christian name, age, nationality, employment and salary of those who have replaced them;

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and in the case of dismissals, a list of the persons who asked for their dismissals; in the case of these replacing them, a list of the persons who recommended their successors. Presented 17th March, 1913.—*Mr. Wilson (Laval).....Not printed.*

120. Return to an Address to His Royal Highness the Governor General of the 5th February, 1912, for a copy of all tenders, contracts, reports and other memoranda of the engineers of the Department of Public Works, orders in council, correspondence and all other documents relating to the construction of a dam for storage purposes at the foot of Lake Timiskaming. Presented 12th February, 1913.—*Mr. Pugsley.*
Not printed.

120*a*. Return to an Order of the House of the 4th March, 1912, for a copy of all contracts, correspondence or writings whatsoever, respecting the construction of a dam in 1902 or 1909, called the Lake Timiskaming dam constructed or built over the rivers forming the inflow or the discharge of the said lake, exchanged between the Government of Canada and the contractor or contractors. Presented 12th February, 1913.—*Mr. Boulay..... .....Not printed.*

121. Return to an Order of the House of the 28th March, 1912, for a return giving a list of the subjects of the oil paintings and water colours which have become the property of the National Gallery of Canada since 1891; and the names of the artists in each case. Presented 12th February, 1913.—*Mr. Burnham.....Not printed.*

122. Return to an Order of the House of the 27th January, 1913, for a copy of all documents, letters, correspondence, reports, recommendations, &c., relating to the petition of Mr. Firmin Thibault, of St. Denis, County of Kamouraska, for his indemnity for having served at the time of the Fenian invasion. Presented 13th February, 1913 — *Mr. Lapointe (Kamouraska)..... .....Not printed.*

123. Return to an Order of the House of the 27th January, 1913, for a return showing what date or dates the government purchased the site for the new Dominion Rifle Range in the County of Carleton, Ontario, from whom were the several parcels of land purchased, and what price per acre was paid for each, the number of acres of land purchased, and the total amount paid therefor, if any buildings have been erected on the said lands by the government, and the cost thereof, the amounts paid by the government for commissions, fees, agency charges, and legal expenses, and to whom in connection with said purchase, the amount of money expended by the Government on the said range for all purposes, from the date of the original purchase of the land up to 23rd January, 1913, and any sums remaining to be paid in any way connected with the purchase of the said range, to whom and the respective amounts thereof, the distance from the post office in the City of Ottawa to the said range, if any line of electric or other railway runs from the City of Ottawa to the said range, and what means of transportation will be provided for riflemen going to and returning from the said range. Presented 13th February, 1913—*Mr. Wilson (Laval).....Not printed.*

124. Return to an Address to His Royal Highness the Governor General of the 10th February, 1913, for a copy of the memorial presented to the Government during the session of 1911-12, by a delegation from the Government of Prince Edward Island asking for an increased provincial subsidy, a copy of which memorial was laid on the Table of the House by the Finance Minister last session of Parliament, but is not now apparently on the files of the House Presented 17th February, 1913.—*Mr. Hughes (Kings, P.E.I.).....Printed for sessional papers only.*

125. Return to an Address to His Royal Highness the Governor General of the 9th December, 1912, for a copy of all papers, letters, telegrams and correspondence between the Government of Canada or any member thereof, since 1st November, 1911, to the pre-

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sent time, with any corporation, company, party or parties, in any way relating to the Customs Tariff upon cement or to the temporary reduction made of the Customs Tariff upon cement; also for a copy of all letters and correspondence by and between members of the Government of Canada during the same period relating to the same subject, and of all papers, documents, memoranda and orders in council relative to the reduction of the Customs Tariff upon cement made by order in council since the close of the last session of parliament. Presented 17th February, 1913.—*Mr. Maclean (Halifax)*.....*Not printed.*

125a. Return to an Address to His Royal Highness the Governor General of the 20th January, 1913, for a copy of all petitions since the 1st of October, 1911, addressed to the Governor General in Council or to any member of the government, asking for a remis ion and the adjustment of duty on cement, of all letters to the ministers individually on the same, of all correspondence and of all orders in council. Presented 21st February, 1913.—*Sir Wilfrid Laurier*.....*Not printed.*

125b. Return to an Address to His Royal Highness the Governor General of the 9th December, 1912, for a copy of all papers, documents, petitions, orders in council, letters and telegrams in any department of the government of Canada, or that passed between the Department of Customs and the Department of Justice or any solicitor, counsel, association, company or individual, during the past twelve months, respecting the imposition of tariff duties upon imported lumber dressed on one side and sized, or respecting the interpretation of tariff item No. 504, together with a printed copy of any stated case, appeal, factum or argument used before the Exchequer Court of Canada or the Supreme Court of Canada, in the matter of the judicial interpretation of tariff item No. 504. Presented 4th June, 1913.—*Mr. Maclean (Halifax)*

Not printed.

126. Return to an Order of the House of the 4th December, 1912, for a copy of all correspondence passing between the government or any member thereof with respect to the east half of Section 27 in township six (6) in range two (2) west of the third meridian. Presented 17th February, 1913. *Mr. Martin (Regina)*.....*Not printed.*

127. Return to an Order of the House of the 27th January, 1913, for a return showing when the militia or regular forces was first called out in Canada since Confederation in aid of the civil authorities, how often, when and where has the same been called out since, the amount of money paid by each municipal corporation for such service in each case, what corps called out on each occasion, whether to quell strikes in each instance or for what purpose. Presented 18th February, 1913.—*Mr. Macdonald.*

Not printed.

128. Return to an Order of the House of the 29th January, 1913, for a copy of all correspondence, papers, &c., concerning the application by James McKelvey, of the town of Sarnia, Ontario, for Fenian Raid Volunteer Bounty. Presented 18th February, 1913.—*Mr. Macdonald*.....*Not printed.*

129. Return to an Order of the House of the 10th February, 1913, for a copy of all documents, correspondence, memorandums, reports, requests for inquiries, of the appointment of commissioners and other documents, relating to the study of the causes for the depopulation of country places and the high cost of living in the eastern provinces of the Dominion. Presented 18th February, 1913.—*Mr. Paquet*.....*Not printed.*

130. Return to an Order of the House of the 9th December, 1912, for a copy of all papers, documents, memoranda and correspondence relating to the application of the Banque Internationale to the Treasury Board for a certificate for the commencement of business. Presented 18th February, 1913.—*Mr. Maclean (Halifax)*.....*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

131. Return to an Order of the House of the 4th December, 1912, for a copy of all papers, documents, telegrams, reports, letters, and instructions regarding smelt and salmon fishing in the Restigouche river and the Baie des Chaleurs since October, 1911, up to date, together with copy of instructions issued to officials of the Department of Marine and Fisheries in that connection. Presented 18th February, 1913.—*Mr. Marcil (Bonaventure)*.....*Not printed.*

132. Return to an Order of the House of the 29th January, 1913, for a copy of all correspondence and papers concerning the increase of salary of Mr. Sevigny, employed at the immigration office at Montreal. Presented 18th February, 1913.—*Mr. Carvell.* *Not printed.*

133. Return to an Order of the House of the 5th February, 1913, for a return showing whether any order for goods has been given by the Department of Public Works since 1st October, 1911, at Montreal, Quebec, St. John and Halifax; tenders asked for in each case; orders for goods given without tenders; names of firms, and amounts in each case. Presented 19th February, 1913.—*Mr. Macdonald*.....*Not printed.*

134. Return to an Order of the House of the 10th December, 1912, for a copy of all correspondence and other papers, in the Department of Public Works, concerning the awarding of a contract for a Welsh coal supply to the various Dominion public buildings in Montreal. Presented 19th February, 1913.—*Mr. Lemieux*....*Not printed.*

135. Return to an Order of the House of the 5th Decemher, 1912, for a return showing how many dredging contracts were let by the Department of Public Works during the year 1911-12, the name of each tenderer and the amount of each tender. Presented 19th February, 1913.—*Mr. Lemieux*.....*Not printed.*

135*a*. Return to an Order of the House of the 4th Decemher, 1912, for a return showing the quantity by cubic yards of dredging made in the harhour of Bathurst hy the dredge *Restigouche* during the months of May, June, July, August, Septemher, October, and November of the year 1911, and during the same months in the year 1912. Presented 19th February, 1913.—*Mr. Turgeon*.....*Not printed.*

135*b*. Return to an Order of the House of the 10th Decemher, 1912, for a copy of all correspondence, documents, recommendations and reports respecting the dredging Des Prairies river, the work done, depth, length and width of channel dredged, the list of men employed to perform that work, their salaries, and the amount of money spent on that work since the 1st of October, 1911, up to the 21st Novemher, 1912. Presented 12th May, 1913.—*Mr. Wilson (Laval)*.....*Not printed*

135*c*. Return to an Order of the House of the 3rd March, 1913, for a copy of all documents, letters, reports of engineers and a detailed statement of expenditure in connection with dredging at Ste. Anne de Restigouche and Cross Point, Bonaventure County. Presented 4th June, 1913.—*Mr. Marcil (Bonaventure)*.....*Not printed.*

135*d*. Return to an Order of the House of the 19th March, 1913, for a return showing the amount of dredging done by the government dredges for private parties or firms in Prince Edward Island, during the season of 1912; the names of the parties or firms for whom this dredging was done; the number of yards of material dredged for each party or firm; the class of material dredged, and the price per yard the government charged for this dredging; who measured the material dredged, and whether it was scow measurement that was made; who recommended the said dredging to be done; if the resident engineer or any engineer was consulted in regard to the measuring, and if the resident engineer or any engineer had control over the matter at all. Presented 6th June, 1913.—*Mr. Hughes (Kings, P.E.I.)*.....*Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

136. Return to an Order of the House of the 9th December, 1912, for a copy of the accounts of Jean Baptiste Lena and of his wife, for work done to the public buildings at Valleyfield, Quebec, in May, 1912; also for a copy of all correspondence, reports and documents relating to the payment in full or a part of their accounts. Presented 19th February, 1913.—*Mr. Papineau*.....*Not printed.*

137. Return to an Order of the House of the 4th December, 1912, for a return showing the amount of money expended in improving the channel of the Ottawa river between the city of Hull and the village of Masson. Presented 19th February, 1913.—*Mr. Devlin.* *Not printed.*

138. Return to an Order of the House of the 4th Decemher, 1912, for a copy of all documents relating to the transferring of P. E. Amiot, resident engineer of the Department of Puhlic Works. Bonaventure, Quehec, to the district of Chicoutimi and Saguenay, and the appointment in his stead, in Bonaventure County, of Charles E. Tache, of Chicoutimi, as resident engineer, with a copy of all the instructions given to the latter and his duties, residence and salary. Presented 19th February, 1913.—*Mr. Marcil (Bonaventure)*.....*Not printed.*

139. Return to an Order of the House of the 4th Decemher, 1912, for a copy of all petitions, correspondence, memoranda, reports, and resolntions of county or other municipal councils of Bonaventure County asking or objecting to certain public works in Bonaventure Connty since Octoher, 1911, with the Minister of Public Works, or any member of the present administration, and replies made thereto. Presented 19th Februarv, 1913.—*Mr. Marcil (Bonaventure)*.....*Not printed.*

140. British Canadian Loan and Investment Company, Limited, Toronto, for year 1911.—(*Senate*).....*Not printed.*

141. Claims of present fish warden, Baker Lake, County of Madawaska, N.B.—(*Senate*). *Not printed.*

141a. Return to an Order of the Honse of the 29th January, 1913, for a copy of all letters, telegrams, reports, information, convictions and other documents in the possession of the Department of Marine and Fisheries or any officer thereof relating to the prosecution in the year 1910, against George Rowlings and James Rowlings, of Musquodoboit Harbour, County of Halifax, for a violation of the fishery regulations. Presented 21st May, 1913.—*Mr. Sinclair*.....*Not printed.*

141b. Return to an Order of the House of the 29th January, 1913, for a copy of all papers, letters, telegrams and documents or other communications, had with the Department of Marine and Fisheries or any official thereof, in regard to the prosecutions against the following parties:—Samuel Stewart, Melvin Hart, Andrew McNeil, Thomas McNeil, Hugh Malcolm, Tom Moffatt, James Waddin, Samuel Wright and Dougald Higgins, of Westville, County of Pictou, for infractions of the Fisheries Act, and of any applications or letters relative to relief from the fines imposed or the return of the same; and also of all papers, letters, and other documents relating to a charge against Rod. Martin, of Westville aforesaid, a fishery guardian, for illegal fishing and other offences. Presented 21st May, 1913.—*Mr. Macdonald*.....*Not printed.*

141a Claims of Messrs. Bonlanger and Son, Montmagny, Quehec.—(*Senate*)....*Not printed.*

142. Copy of Report of Minister of Justice in re Florence Mining Company.—(*Senate*). *Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

143. Instruction sent to the different Lieutenant Governors of different provinces of Canada, with commissions.—(*Senate*).....*Not printed.*

144. Return to an Order of the House of the 15th January, 1913, for a copy of all papers, letters, documents, telegrams, reports and opinions in relation to the claim of William Iceton, of Purcell's Cove for a return of a boat from the Department of Marine and Fisheries or any other department. Presented 20th February, 1913.—*Mr. Macdonald*.....*Not printed.*

145. Return to an Address to His Royal Highness the Governor General of the 9th December 1912, for a copy of all papers, telegrams, letters and orders in council respecting the transfer of the property known as the Police Point Reserve to the corporation of the City of Medicine Hat, Alberta. Presented 20th February, 1913.—*Mr. Buchanan.* *Not printed.*

146. Return to an Order of the House of the 29th January, 1913, for a copy of the inquiry made by F. B. Atkinson, Lévis, as to an accident that happened to the horse of Arsene Lanzier, at Amqui, County of Rimouski, on the 19th February, 1912. Presented 20th February, 1913.—*Mr. Boulay*.....*Not printed.*

147. Correspondence, memoranda, &c., in respect to the issue of a patent for the N. ½ of S. W. ¼ of section 8, in township 49, range 26, west of the 2nd meridian, to one Arthur Donaldson, bearing date the 19th November, 1912. Presented by Hon. Mr. Roche, 20th February, 1913.....*Not printed.*

147*a*. Return to an Order of the House of the 12th February, 1913, for a copy of all letters, telegrams and other documents with respect to the north half of the southwest quarter of section eight (8), township forty-nine (49), range twenty-six (26), west of the second meridian, province of Saskatchewan, and the granting of a homestead entry for the said land to one Arthur Donaldson. Presented 6th June, 1913.—*Mr. Martin (Regina)*.....*Not printed.*

148. Return to an Order of the House of the 12th February, 1913, for a copy of all papers, reports and other documents relating to the delay of the Indian Department in issuing patents for lands purchased from the St. Peters band of Indians, and forming part of the St. Peters Indian reserve, Manitoba. Presented 25th February, 1913.—*Mr. Oliver*.....*Not printed.*

149. Return an Address to His Royal Highness the Governor General of the 27th January, 1913, for a copy of all applications addressed to the Government by the Algoma Steel Company for remission of duties on rails imported by the said company at Fort William; of all correspondence on the same, of all evidence sought and obtained by the government and supplied by the company in support of its application; and of all orders in council ordering such remission of duties. Presented 25th February, 1913.—*Sir Wilfrid Laurier*.....*Not printed.*

150. Return to an Order of the House of the 24th February, 1913, for a return showing the stenographers and secretaries of the House of Commons, and the names of the members for whom each of them work. Presented 26th February, 1913.—*Mr. Boulay.* *Not printed.*

150*a*. Return to an Order of the House of the 31st March, ultimo, for a return giving the names and home addresses of the persons employed in the House of Commons as stenographers to members. Presented 1st April, 1913.—*Mr. Martin (Regina).* *Not printed.*

CONTENTS OF VOLUME 27—*Continued.*

151. Return to an Order of the House of the 16th January, 1913, for a return showing the number of bushels of grain and barrels or sacks of flour which were shipped from Montreal, Quebec, St. John, N.B., and Halifax, for twelve months preceding the 31st day of December, 1912; the kinds of each product respectively, and the quantities of said commodities at each of above points which were domestic and foreign. Presented 26th February, 1913.—*Mr. Bennett (Simcoe)*.....*Not printed.*

152. Return to an Order of the House of the 19th February, 1913, for a return showing in detail the quantity and values, respectively, of the imports and exports of Canada with Great Britain, United States, Australia and New Zealand, during the year ending 31st March, 1912, in horses, cattle, sheep, hogs, bacon, hams, fresh and salted beef, lard, tallow, mutton, canned meats, butter, cheese, eggs, poultry and apples. Presented 26th February, 1913.—*Mr. Sutherland*.....*Not printed.*

153. Return to an Address to His Royal Highness the Governor General of the 26th February, 1912, for a copy of all letters, documents and correspondence relating to action by the Government in regrd to the relief of the shareholders and depositors of the Farmer's Bank, and of the order in council appointing Sir William Meredith as Commisioner, and all correspondence in relation thereto. Presented 26th February, 1913. —*Mr. Macdonald*..... ....*Not printed.*

153*a*. Report of the Honourable Sir William Ralph Meredith, Kt., Commissioner appointed to make investigation into all matters connected with the Farmers Bank of Canada. Presented by Hon. Mr. White, 26th February, 1913.

Printed for distribution and sessional papers.

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(This volnme is bound in three parts.)

153*b*. Report of Royal Commission authorized by orders in council dated 19th day of July, 1912, and the 5th day of August, 1912, to inquire into alleged complaints as to methods of weighing butter and cheese in Montreal, and also as to the methods of payment. Presented by Hon. Mr. Burrell, 30th May, 1913.

Printed for distribution and sessional papers.

154. Return to an Order of the House of the 27th January, 1912, for a return showing the amount of the subsidy paid to each of the four original provinces of the Dominion at Confederation, and the population on which such payment was based; the subsidy payable to each of the remaining five provinces on entering the union, and the population on which such payment was based; the sum added to the subsidy of any province as better terms, and the date which such addition was made respectively; the details of each readjustment of subsidies since 1867, and the yearly subsidy at present payable to each province, with the population on which such payment is based, and the original debt allowance, if any, respectively, placed to the credit of each province on entering the union. Presented 27th February, 1913.—*Mr. Sinclair.*

Printed for sessional papers only.

155. Return to an Order of the House of the 29th January, 1913, for a copy of all correspondence in regard to the disposition of the Marine Hospital at Pictou to the town of Pictou, or any other corporation or person. Presented 27th February, 1913.—*Mr. Macdonald*..... ....*Not printed.*

156. Return to an Order of the House of the 29th January, 1913, for a copy of all letters, tenders, contracts, papers and other documents in the possession of the Department of Marine and Fisheries relating to the making and cancellation of a contract or agreement between the said department and one Charles G. Giffin, of Isaac Harbour,

CONTENTS OF VOLUME 28.—*Continued.*

N.S., to perform certain services for the lobster hatchery at that place, and also relating to a subsequent agreement with one Philip McArthur to perform similar duties. Presented 27th February, 1913.—*Mr. Sinclair*.....*Not printed.*

157. Return to an Order of the House of the 29th January, 1913, for a copy of all papers and correspondence concerning the claim of Charles Mennier, ex-Collector of Customs at Marieville, Quebec, for rent. Presented 28th February, 1913.—*Mr. Lemieux.*
Not printed.

158. Return to an Order of the House of the 9th December, 1912, for a copy of all letters, correspondence, documents and reports relating to the closing of the post office at Pomket river, Antigonish County, Nova Scotia, and the cancellation of the contract for the carrying of the mail between Heatherton and Pomket river. Presented 28th February, 1913.—*Mr. Chisholm (Antigonish)*.....*Not printed.*

158a. Return to an Order of the House of the 27th January, 1913, for a copy of all letters, telegrams, petitions and other correspondence and documents received by the Post Office Department during the last twelve months from the honourable member for East Grey and others, relating to the closing of the post office at Harkaway, County of Grey province of Ontario, and of the proposed change in the mail service. Presented 24th March, 1913.—*Mr. Lanctot*.....*Not printed.*

159. Claims put forth by and on behalf of Indians of British Columbia—Report of James T. McKenna on.—*(Senate)*.....*Not printed.*

159a. Return to an Address to His Royal Highness the Governor General of the 20th January, 1913, for a copy of all correspondence between the Government of British Columbia and the Government of Canada concerning the rights and claims of the Indians in the province, and of all orders in council with regard to the same. Presented 14th May, 1913.—*Sir Wilfrid Laurier*.....*Not printed*

159b. Return to an Order of the House of the 28th April, 1913, for a copy of all correspondence, reports and recommendations from Rev. R. L. Macdonald, Indian agent at Salmon River reserve, Richmond County, N.S., relating to the Indian school in said reserve; and of all correspondence and instructions from the Department of Indian Affairs to the said Indian agent, relating to the same; also a copy of all complaints, charges and reports against Miss Charlotte M. Devereaux, teacher of the said school, and of all correspondence and recommendations relating to the appointment of Earnest McNeil to succeed her, since 1st January, 1912. Presented 23rd May, 1913.—*Mr. Kyte*.....*Not printed.*

159c. Return to an Order of the House of the 12th May, 1913, for a copy of the last surrender and of all papers, correspondence and other documents in connection with the surrender of part of the White Bear Indian Reserve; together with a copy of all letters and telegrams referring to this surrender by officials of the Department or others, and of the authority on which this surrender was taken, the number of acres surrendered, and how disposed of. Presented 23rd May, 1913.—*Mr. Bradbury.*
Not printed.

159d. Return to an Order of the House of the 30th April, 1913, for a copy of all letters, papers, memoranda and other documents, dated since 1st January, 1912, relating to the Kitsilano Indian Reserve in the City of Vancouver. Presented 23rd May, 1913.—*Mr. Oliver*.....*Not printed.*

160. Immigrants—number of, who settled in Canada, in 1911-12, and from whence.—*(Senate).*
Not printed.

CONTENTS OF VOLUME 28.—*Continued.*

160*a*. Return to an Order of the House of the 7th May, 1913, for a return showing the number of immigrants coming into Canada during the year ending 31st March, 1913, inspected by the government medical inspectors; the total cost of such medical inspections; the number of medical doctors employed by the government during that period; the name, salary and location of each, including those resident in Ottawa. Presented 6th June, 1913.—*Mr. Schaffner*.....*Not printed.*

161. Correspondence with Mr. V. Steffansson concerning northern expedition. Presented by Hon. Mr. Hazen, 3rd March, 1913.....*Not printed.*

161*a*. Copy of order in council No. P.C. 406 of the 22nd February, 1913, with reference to Mr. V. Steffansson's proposed northern expedition. Presented by Hon. Mr. Hazen, 10th March, 1913.....*Not printed.*

162. Return to an Address to His Royal Highness the Governor General of the 25th March, 1912, for a copy of all letters, requests, petitions, orders in council and other documents in the possession of the Department of Marine and Fisheries relating to the change in the fishery regulations by which steam trawlers were prohibited from participating in the fishing bounty. Presented 3rd March, 1913.—*Mr. Sinclair.*
Not printed.

162*a*. Return to an Address to His Royal Highness the Governor General, of the 10th February, 1913, for a copy of all petitions, correspondence, reports of experts or officers, of orders in council, minutes of council, and of other papers and documents in the possession of the Department of Marine and Fisheries, or any department of the government, relating to steam trawling on the Atlantic seaboard. Presented 15th April, 1913.—*Mr. Sinclair*.....*Not printed.*

163. Return to an Order of the House of the 19th February, 1913, for a copy of all correspondence, papers, accounts, vouchers, concerning the purchase and subsequent repairs of a private car by the Department of Militia and Defence, from the Canadian Northern Railway Company. Presented 3rd March, 1913.—*Mr. Lemieux.*
Not printed.

164. Return to an Order of the House of the 24th February, 1913, for a return showing separately the amount paid by the Department of Indian Affairs for medical attendance on account of the Indians on the Micmac reserve of Ste. Anne de Restigouche, Quebec, for each year from 1900 to 1913, inclusive, and to whom paid. Presented 10th March, 1913. *Mr. Marcil (Bonaventure)*.....*Not printed.*

165. Return to an Order of the House of the 19th February, 1913, for a copy of all correspondence, letters, telegrams and other documents relative to the sale of alleged Indian lands at Nyanza, riding of North Cape Bretou and Victoria, N.S., to one Philip McDonald, such sale having taken place about the year 1877. Presented 17th March, 1913.—*Mr. McKenzie*.....*Not printed.*

165*a*. Return to an Order of the House of the 7th May, 1913, for a return showing the number of acres surrendered by the Coté's Band of Indians, the number of acres sold by private sale, the number of acres still unsold; together with a copy of all letters from persons who made application for purchase of surrendered lands in Coté's reserve, or from any person on behalf of purchasers and replies thereto; and of all reports, letters or memoranda addressed to the Superintendent General of Indian Affairs, from any officer of the department respectiug the private sale of said lands; also a copy of any document or documents covering the authority under which these lands were sold by private sale, and of all letters addressed to the department, or any officer of department, respecting the sale of said lands. Presented 3rd June, 1913. *Mr. Bradbury*.....*Not printed.*

CONTENTS OF VOLUME 23.—*Continued.*

166. Return to an Order of the House of the 12th February, 1913, for a copy of all letters, reports and other documents received by the Minister of Labour regarding labour conditions on the Grand Trunk Pacific between Tête Jaune Cache and Fort George. Presented 17th March, 1913.—*Mr. Oliver*.....*Not printed*

167. Return to an Address to His Royal Highness the Governor General of the 3rd February, 1913, for a copy of all telegrams, letters and other documents passing between the Government of Canada, or any member thereof, and the Government of the Province of Saskatchewan, or any member thereof, with respect to chapter 17 of the statutes of Saskatchewan, 1912, being an Act to prevent the employment of female labour in certain capacities. Presented 17th March, 1913.—*Mr. Martin (Regina)*.....*Not printed.*

168. Return to an Order of the House of the 10th December, 1912, for a copy of all correspondence, petitions and other papers received by the Prime Minister, or any member of the government, since the 1st April, 1912, in connection with the school system established in that portion of the Keewatin Territory annexed to the province of Manitoba. Presented 17th March, 1913.—*Mr. Macdonald*.....*Not printed.*

169. Return to an Order of the House of the 29th January, 1913, for a return showing the number of accidents to lock gates or bridges on the Welland Canal during the year ending 25th November, 1912, the nature of the accidents, the amount of damage in each case and the amount recovered by the Government from vessel owners in each instance. Presented 18th March, 1913.—*Mr. Graham*.....*Not printed.*

170 Return to an Order of the House of the 3rd March, 1913, for a copy of the contract passed on the 6th day of August, 1910, between the City of Quebec and the Transcontinental Railway Commissioners, for the acquisition by the latter of the property known as Champlain Market, to be used as a station and terminals for the said railway; of all the correspondence between the said city and the present Commissioner of the said railway, with the Minister of Railways, or any other Minister, with regard to the non-execution of the said contract by the said commission. Presented 18th March, 1913.—*Sir Wilfrid Laurier*.....*Printed for sessional papers only.*

171. Return to an Order of the House of the 29th of January, 1913, for a copy of all letters, correspondence, &c., respecting the request for suspension by H. Boulay, of J. Stahl, assistant inspector of immigration on the railway. Presented 19th March, 1913.—*Mr. Boulay* .....*Not printed.*

172. Return to an Order of the House of the 17th February, 1913, for a return showing the total area of land thrown open for pre-emption and purchased homesteads in each of the provinces of Saskatchewan and Alberta since the passing of the Dominion Lands Act of 1908; also the number of acres of such lands which have been disposed of by way of pre-emptions and purchased homesteads in each of the said provinces, the amount of principal money collected on account of such lands in each of the said provinces up to 31st December, 1912, and the amount of interest collected on account of such lands in each of the said provinces to 31st December, 1912. Presented 19th March, 1913.—*Mr. Martin (Regina)*.....*Not printed*

173. Return to an Order of the House of the 10th February, 1913, for a copy of all letters, correspondence, memorials and other documents received by the Right Honourable the Prime Minister and the Honourable the Minister of Justice, since the 1st day of January, 1912, relating to the request by county court judges for an increase of salary and for an amendment to the Judges Act with respect to retiring allowances. Presented 26th March, 1913.—*Mr. Proulx*.....*Not printed.*

CONTENTS OF VOLUME 28.—*Continued.*

174. Return to an Order of the House of the 13th February, 1913, for a return showing the names of the keepers in Portsmouth penitentiary, and their religious belief; the names of any of the said keepers who may have been dismissed, the date, charges and on whose recommendation were they reinstated. Presented 26th March, 1913.—*Mr. Edwards*.....*Not printed.*

174a. Return to an Order of the House of the 13th February, 1913, for the name of the discipline officer in charge of each of the following departments in Portsmouth penitentiary, the date when each was first appointed on the penitentiary staff, the date to his present position, and the religious belief of each: Quarry, farm, warden's residence and grounds, blacksmith shop, bath room and laundry, stone shed, tailor and shoe shop, changing room, stone pile, sewage plant, asylum ward, cell wings, library and Roman Catholic and Protestant chapels, hospital, shop dome, carpenter, tin and paint shop, and prison of isolation. Presented 26th March, 1913.—*Mr. Edwards.*
Not printed.

175. Return to an Order of the House of the 17th February, 1913, for a copy of all statements of account for salary or remuneration to the Commissioner, and his expenses, for witness fees and all other expenses in connection with the investigations by Commissioner Duchemin, of the following persons in Antigonish County namely: Patrick M. Decoste, deckhand SS. *Scotia*, Harbour au Boucher; William R. Fongère, sectionman, Harbour au Bouche; Allen Kinney, sectionman, Linwood; Hubert Myatte, sectionman, Tracadie; John McDonell, sectionman, Afton Station; John W. Malanson, sectionman, Afton; James Armstrong, sectionman, Heatherton; Charles Landry, sectionman, Pomket; William S. Landry, section foreman, Pomket; Colin McDonald, sectionman, James River; Archibald Chisholm, station agent, Heatherton; Joseph Benoit, station agent, Pomket; Alex. R. McAdam, fishery officer, Malignant Cove; Alex. McDonald, sub-collector, Doctors Brook; Charles L. Gass, sub-collector, Bayfield; Jeffrey M. Crispo, sub-collector, Harbour au Bonche; Hugh R. McAdam, postmaster, Arisaig; Thomas J. Sears, postmaster, Lochaber, Charles L. Gass, postmaster, Bayfield; and Joseph P. Benoit, postmaster, Pomquet; also the expenses in detail, of and incidental to the investigation by said Commissioner Duchemin of the charges made against John J. McDonald, postmaster, McArra's Brook; Archibald Stewart, section foreman, Harbour au Bouche; Rouald McFarlane, section foreman, Williams Point; Henry Williams, sectionman, Marshy Hope; and John W. McInnes, bridge foreman Intercolonial Railway, Antigonish. Presented 26th March, 1913.—*Mr. Chisholm (Antigonish)*.....*Not printed.*

175a. Return to an Order of the House of the 28th April, 1913, for a return showing the date of the appointment of H. P. Duchemin, Investigating Commissioner for Eastern Nova Scotia; the number of days he has been employed by the government since the appointment; the gross amount paid to Mr. Duchemin as an allowance for his services, excluding travelling expenses or other outlay; the amount which has been paid to Mr. Duchemin to date for travelling expenses, living expenses, witness fees, and other sundry expenses, respectively. Presented 21st May, 1913.—*Mr. Sinclair.*
Not printed.

176. Return to an Order of the House of the 4th December, 1912, for a copy of the report or reports made by C. E. Taché, resident engineer of Bonaventure County, Quebec, on public works existing or asked for in that constituency since October, 1911, up to date. Presented 28th March, 1913.—*Mr. Marcil (Bonaventure)*.....*Not printed.*

177. Return to an Order of the House of the 6th February, 1913, for a return showing what properties within the area north of Wellington street and west of Bank street, in the City of Ottawa, have been purchased or acquired by the Government; from whom the said purchases were made, and the price paid, or agreed to be paid, in each case; the

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number of said properties not yet paid for, the names of the owners thereof, and amount, if any, in dispute in each case; the names of the persons who were employed in any capacity, or for any purpose, in connection with the purchase of the said properties, and the terms of their employment; the amount which has been paid to each, and further amounts to be paid to such persons, giving their respective names; whether the Government has employed any persons or agents to collect rent from the tenants or occupants of any of the said properties, if so, the names of such rent collectors, for what period employed, and amount by way of salary, fees, or commission, paid to each; the total amount paid by the Government up to 31st January, 1913, in connection with the purchase or acquisition of the said properties. Presented 28th March, 1913.—*Mr. Murphy* .....*Not printed.*

178. Return to an Order of the House of the 24th January, 1913, for a copy of all correspondence between the Minister of Public Works and H. Morel, M.P.P., for East Nipissing, in any way relating to the construction of a road or highway from North Bay to Sturgeon Falls, Ontario; and of all petitions, correspondence, surveys, and engineers' reports in any way connected with the building of the said road or highway. Presented 28th March, 1913.—*Mr. Murphy*.....*Not printed.*

179. Return to an Order of the House of the 4th December, 1912, for a copy of all pay-lists, letters, documents, telegrams and other papers in connection with the expenditures made on Brulé wharf in the County of Colchester during the last two years. Presented 28th March, 1913.—*Mr. Macdonald*.....*Not printed.*

179a. Return to an Order of the House of the 10th December, 1912, for a copy of all papers, documents, tenders and correspondence relating in any way to the construction of a wharf at Kraut Point, Lunenburg County, N.S. Presented 28th March, 1913.—*Mr. Maclean (Halifax)*.....*Not printed.*

180. Return to an Order of the House of the 29th January, 1913, for a copy of all correspondence, papers, &c., concerning the application made by the Eastern Canada Power Company, with a view to raise the head of the River St. Lawrence in the vicinity of Coteau, Cedar, Split Rock and Cascade rapids to the level of the water in Lake St. François. Presented 28th March, 1913.—*Mr. Lemieux*.....*Not printed.*

181. Return to an Order of the House of the 4th December, 1912, for a copy of all correspondence, letters and telegrams addressed by the Conservative candidate in the County of Gloucester at the election of 21st September, 1911, to the Minister of Public Works from the day he took his oath of office, on 10th October, 1911, up to the 31st December, of the same year, on the subject of public works then under construction in the said county. Presented 28th March, 1913.—*Mr. Turgeon*.....*Not printed.*

182. Return to an Order of the House of the 10th March, 1913, for a return showing the number of men of the R. C. regiment at Aldershot, during the summer of 1912, previous to the regular militia camp; date of going into camp; number there during said time; whether tenders for supplies for these men were called for; number of tenders received and from whom; if any contracts were awarded on said tenders and, if not, what was done with the said tenders; how and from whom were supplies for these men obtained; the prices paid during said time per pound respectively, for meat, sugar, butter, tea, coffee bacon, bread, and how much per bushel for vegetables; the cost per ration for supplies for said men of the R. C. regiment at Aldershot camp during the time aforesaid; the cost per ration for supplies to the regular militia camp under contract during the annual drill in the fall of 1912. Presented 28th March, 1913.—*Mr. Kyte*.....*Not printed.*

CONTENTS OF VOLUME 28.—*Continued.*

183. Report on wholesale prices in Canada, 1912, by R. H. Coats, B.A., F.S.S., editor of the *Labour Gazette*. Presented by Hon. Mr. Crothers, 28th March, 1913....*Not printed.*

184. Area of territories added to Ontario and Quebec, by Statutes of 1912.—(*Senate*). *Not printed.*

185. Relating to recent increase in prices charged Canadian fishermen for manilla cord. (*Senate*).....*Not printed.*

186. Report of the Pilotage Commission of Quebec. Presented by Hon. Mr. Hazen, 28th March, 1913.....*Not printed.*

187. Return to an Order of the House of the 26th February, 1913, for a copy of all memoranda, letters, papers, telegrams and other documents in the possession of the Department of the Interior relating to the S. W. 36-16-27, W. 2. Presented 31st March, 1913. —*Mr. Knowles*.....*Not printed.*

187*a*. Return to an Order of the House of the 3rd March, 1913, for a copy of all correspondence, telegrams and other papers in connection with the southwest ¼ of 4-9-14 west of 2nd meridian. Presented 10th April, 1913.—*Mr. Bradbury*.....*Not printed.*

187*b*. Return to an Order of the House of the 26th March, 1913, for a copy of all papers, letters, memoranda and other documents relating to the northwest of 30-25-7-2. Presented 25th April, 1913.—*Mr. Oliver*.....*Not printed.*

187*c*. Return to an Order of the House of the 3rd March, 1913,—1. For a copy of all correspondence and other papers in connection with the disposal of the following lands and the claim of James W. Brown in connection with these lands:—

Part of S.E. ¼ section 21-20-21-W. 2nd meridian, area 5/100ths acre.
Part of N.E. ¼ section 21-20-21-W. 2nd meridian, area 11 9/100ths acre
Part of S.E. ¼ section 20-20-21-W. 2nd meridian, area 80 acres.
Part of S.W. ¼ section 28-20-21-W. 2nd meridian, area 72 4/100ths acres.
Whole of S.E. ¼ section 28-20-21-W. 2nd meridian, area 160 acres.
Whole of N.E. ¼ section 32-20-21-W. 2nd meridian, area 160 acres.
Part of S.E. ¼ section 32-20-21-W. 2nd meridian, area 80 acres.
Whole of N.W. ¼ section 5-21-21-W. 2nd meridian, area 160 acres.
Whole of S.E. ¼ section 5-21-21-W. 2nd meridian, area 160 acres.
Part of N.E. ¼ section 5-21-21-W. 2nd meridian, area 123 85/100ths acres.
Whole of S.W. ¼ section 5-21-21-W. 2nd meridian, area 160 acres.

2. Also of all papers in connection with the disposal of the whole of the northwest quarter-section 22-20-21, west of the second meridian; and part of S.W. ¼, 2-20-21-W. of the second meridian; and of all correspondence and papers in connection with Alexander Hurst Brown's claim *re* these lands. Presented 30th April, 1913.—*Mr. Bradbury*.....*Not printed.*

187*d*. Return to an Order of the House of the 9th April, 1913, for a copy of all letters, papers, telegrams and other documents in connection with the sale of the N.W. quarter-section 29 10-18-W. . Presented 13th May, 1913.—*Mr. Turriff*.....*Not printed.*

187*e*. Return to an Order of the House of the 28th April, 1913, for a copy of all letters, memoranda and other documents relating to the northeast quarter of 14-75-15-5, during the years 1911, 1912, and 1913 to date. Presented 13th May, 1913.—*Mr. Oliver*. *Not printed.*

CONTENTS OF VOLUME 28.—*Continued.*

187*f*. Return to an Order of the House of the 31st March, 1913, for a copy of all papers, telegrams, applications, and other documents in connection with the S.W. 2-19-20, west 2nd M. Homestead, patented 3rd June, 1892; the S. ½ of N.E. 20-20-21, west 2nd M. patented 11th October, 1901, N.W.H.B., as assignee of Edward Belcher; the S.E. ¼ of 22-20-21, west 2nd M., N.W.H.B., patented 22nd September, 1900, as assignee of Louis McGillies; the S.E. ¼ of 28-20-21, west 2nd M., N.W.H.B., patented 26th August, 1901, as assignee of J. Bte. Fagant, jr., and the E. ½ of S.E. ¼ of 32-20-21, west 2nd M., N.W.H.B., patented 11th September, 1901, as assignee of Jos. Alexander; and of all papers in connection with any claims of G. W. Brown or others in connection with these lands. Presented 3rd June, 1913.—*Mr. Bradbury*.....*Not printed.*

187*g*. Return to an Order of the House of the 31st March, 1913, for a copy of all papers, telegrams, applications and other documents regarding the S.W. ¼, 28-20-21, west 2nd M., N.W.H.B., patented 1st March, 1909, as assignee of Norbert Bellehumeur; and the W. ½ of S.E. ¼, 32, 20, 21, west 2nd M., N.W.H.B., patented 1st March, 1909, as assignee of Norbert Bellehumeur; and of all papers in connection with any claims by Norman McKenzie or others against the Government in connection with these lands. Presented 4th June, 1913.—*Mr. Bradbury*.....*Not printed.*

188. Return to an Order of the House of the 10th March, 1913, for a copy of all correspondence or communication of any kind between the Department of Insurance at Ottawa and the Department of Insurance at Toronto since June, 1907, touching the transfer of the Canadian Guardian Life Insurance Company from the jurisdiction of the Insurance Department at Ottawa to that of the jurisdiction of the Insurance Department at Toronto; of all correspondence, if any, between the Insurance Department at Ottawa and the *Saturday Night*, newspaper of Toronto, touching the affairs of the Canadian Guardian Life Insurance Company or the International Insurance Company, Limited; and of all correspondence and other communications between the Department of Insurance at Ottawa and the Government of the province of Alberta in reference to the affairs of the Canadian Guardian Life Insurance Company or the International Insurance Company, Limited. Presented 31st March, 1913.—*Mr. German.*

Not printed.

189. Copy of an Order in Council, &c., respecting a contribution of $30,000 to assist in alleviating the distress of the sufferers by the disastrous cyclone which swept over the City of Regina and its vicinity. Presented by Hon. Mr. White, 31st March, 1913.

Not printed.

190. Copy of correspondence respecting the Treaty of Commerce and Navigation between the United Kingdom and Japan. Presented by Hon. Mr. Borden, 1st April, 1913.

Printed for sessional papers only.

190*a*. From Imperial Consulate General of Japan for the Dominion of Canada. The undersigned, His Imperial Majesty's Consul General at Ottawa, duly authorized by His Government, has the honour to declare that the Imperial Japanese Government are fully prepared to maintain with equal effectiveness the limitation and control which they have since 1908 exercised in the regulation of emigration from Japan to Canada. 11th April, 1913. Presented by Hon. Mr. Borden, 11th April, 1913.....*Not printed.*

191. Copy of the order in council in connection with the appointment of a Commission to inquire into the claims of the province of British Columbia for exceptional treatment. Presented by Hon. Mr. Borden, 1st April, 1913.....*Printed for sessional papers only.*

191*a*. Memorandum *re* British Columbia's claims for special consideration. Presented by Hon. Mr. Borden, 1st April, 1913.....*Printed for sessional papers only.*

CONTENTS OF VOLUME 28.—*Continued.*

191*b*. Copies of orders in council, &c., relating to the appointment of commissioners to adjust all matters relating to Indian lands and Indian affairs generally in the province of British Columbia. Presented by Hon. Mr. Borden, 17th April, 1913.
Not printed.

191*c*. Report of the Royal Commission appointed to inquire into and report upon the law respecting pilotage and its administration in the pilotage districts of Montreal and Quebec; and what changes, if any, are desirable therein; and also, a letter addressed to the Minister of Marine and Fisheries from Mr. Ajutor Lachauce, one of the commissioners. Presented by Hon. Mr. Hazen, 18th April, 1913.....*Not printed.*

191*d*. Report of Royal Commission on Industrial Training and Technical Education, Parts I, II, III, and IV. Presented by Hon. Mr. Crothers, 4th June, 1913.
Printed for distribution and sessional papers.

192. Return to an Order of the House of the 24th February, 1913, for a copy of all memoranda, letters, papers and documents relating to the setting apart of a forest reserve on the north side of the Saskatchewan river opposite the City of Prince Albert. Presented 2nd April, 1913.—*Mr. Oliver*.....*Not printed.*

192*a*. Return to an Order of the House of the 26th February, 1913, for a copy of all memoranda, reports, letters, and other documents of any kind in the possession of the Department of the Interior relating to the suitability for forest reserve or for homesteading purposes, of the whole or any part of townships 24 and 25, range 27, west of the first meridian, now forming part of the Riding Mountain Forest Reserve. Presented 11th April, 1913.—*Mr. Oliver*.....*Not printed.*

193. Return to an Order of the House of the 10th February, 1913, for a copy of all correspondence exchanged between the Department of Marine and Fisheries and the member for Temiscouata, and all other persons, respecting the placing of a light or line of lights on wharf at Ile Verte, County of Temiscouata. Presented 4th April, 1913.—*Mr. Paquet*.....*Not printed.*

194. Copy of a report of the Committee of the Privy Council, approved by His Excellency the Administrator, on the 5th April, 1913, relative to a contract for an ocean mail, passenger and freight steamship service between Canada and Great Britain and Great Britain and Canada, together with the articles of agreement for the said service. Presented by Hon. Mr. Pelletier, 7th April, 1913.....*Not printed.*

195. Return to an Order of the House of the 10th March, 1913, for a statement showing the total volume of trade, in import and export, respectively, between Canada and Newfoundland for each year during the period from the 1st day of January, 1896, to the 1st day of January, 1913, and of what the said trade consisted of each year.

2. The volume of trade between Newfoundland and the West Indian Islands, included in the West Indian trade agreement with Canada, dated the 9th day of April, 1912, during the years 1909, 1910, 1911 and 1912, in import and export, and of what the said import and export consisted of each year. Presented 10th April, 1913.—*Mr. McKenzie.*
Not printed.

195*a*. Supplementary return to an Order of the House of the 10th March, 1913, for a statement showing the total volume of trade, in import and export, respectively, between Canada and Newfoundland for each year during the period from the 1st day of January, 1896, to the 1st day of January, 1913, and of what the said trade consisted of each year.

CONTENTS OF VOLUME 28.—*Continued.*

2. The volume of trade between Newfoundland and the West Indian Islands, included in the West Indian trade agreement with Canada, dated the 9th day of April, 1912, during the years 1909, 1910 1911 and 1912, in import and export, and of what the said import and export consisted of each year. Presented 21st April, 1913.—*Mr. McKenzie* ....*Not printed.*

196. Return to an Order of the House of the 9th December, 1912, for a copy of all letters, telegrams, and correspondence referring in any way to the purchase or leasing of the property in Antigonish, N.S., now in use as a gun shed or store house for the equipment of the 18th Field Battery of Artillery. Presented 14th April, 1913.—*Mr. Chisholm (Antigonish)*..... .....*Not printed.*

197. Return to an Order of the House of the 19th March, 1913, for a copy of all tenders asking for the construction of a drill hall at Fernie, B.C., of all correspondence concerning the awarding of the contract, and of all correspondence and documents regarding said tender and contract. Presented 14th April, 1913.—*Sir Wilfrid Laurier. Not printed.*

197*a*. Supplementary return to an Order of the House of the 19th March, 1913, for a copy of all tenders asking for the construction of a drill hall at Fernie, B.C., of all correspondence concerning the awarding of the contract, and of all correspondence and documents regarding said tender and contract. Presented 6th June, 1913.—*Sir Wilfrid Laurier*..... .....*Not printed.*

198. Return to an Order of the House of the 24th February, 1913, for a copy of all correspondence and documents between the government of Canada or any officer thereof, and one Miss Mastin, of England, relating to a presentation of certain chinaware and other curiosities, made to the Government by the said Miss Mastin, in memory of the defeat at the polls of the agreement relating to reciprocity with the United States. Presented 14th April, 1913.—*Mr. Sinclair*.....*Not printed.*

199. Return to an Order of the House of the 19th March, 1913, for a return showing the names, professions or occupations, residences, the date of appointment, and the salary in each case, of all correspondents of the *Labour Gazette*, and also the number of changes made in that particular for the year 1912. Presented 22nd April, 1913.—*Mr. Verville* ....*Not printed.*

200. Return to an Order of the House of the 26th March, 1913, for a return showing the amount of seed grain supplied to settlers in Peace River during the year 1912; the amount of seed grain being provided for settlers in Peace River during 1913; who distributed the seed grain supplied in 1912 and who is authorized to distribute seed grain in 1913; under what conditions seed grain was supplied during 1912, and those proposed for 1913; if provisions were supplied during 1912, what the conditions were and who gave out the supplies; if it is intended to supply provisions in 1913, what conditions will be given and who will give them out. Presented 25th April, 1913.—*Mr. Oliver* ....*Not printed.*

201. Return to an Order of the House of the 7th April, 1913, for a copy of all documents in the Department of the Interior prior to the issue of the Crown patents relating to Lot No. 217 of the Hudson Bay Company Survey, in the parish of St. John, Winnipeg. Presented 25th April, 1913.—*Mr. Proulx*.....*Not printed.*

202. Return to an Order of the House of the 31st March, 1913, for a copy of all correspondence claims and reports with reference to compensation claimed by owners of horses attached to the 10th Field Battery at Camp Petawawa in the summer of 1912, by rea-

CONTENTS OF VOLUME 28.—*Continued.*

son of damage or disease contracted while in the service; also of all such claims paid, the amounts in each case, and the persons to whom paid. Presented 25th April, 1913.—*Mr. Carvell*.....*Not printed*

203. Return to an Order of the House of the 11th December, 1912, for a copy of all papers, documents, pay-rolls, accounts, receipts, and correspondence in connection with all expenditures of money made in 1912 upon the Petite Rivière breakwater, Lunenburg County, Nova Scotia. Presented 29th April, 1913.—*Mr. Maclean (Halifax)*. *Not printed.*

203a. Return to an Address to His Royal Highness the Governor General of the 9th December, 1912, for a copy of all advertisements tenders, contracts, orders in council, letters, correspondence, &c., relating to the construction of a wharf or breakwater at Seaforth, Halifax County, N.S. Presented 29th April, 1913.—*Mr. Maclean (Halifax)*. *Not printed.*

203b. Return to an Order of the House of the 20th March, 1912, for a copy of all documents, letters, correspondence, petitions, reports, &c., addressed to the Department of Public Works since the 21st September last on the subject of a wharf now under construction at St. Croix, in the County of Lotbinière, province of Quebec. Presented 29th April, 1913.—*Mr. Fortier*.....*Not printed.*

203c. Return to an Order of the House of the 19th March, 1913, for a return showing whether the repairs to Red Point wharf, Lot 48, Prince Edward Island, have been completed; if the work was done by tender or by day labour; if by tender, with whom the contract was made; if by day labour, the number of superintendents, inspectors, or overseers employed, their names, the number of days each did work, and the wages per day paid to each; the number of men employed, their names, the number of days each did work and the wages per day paid to each; who supplied the materials; the amount of each kind or class used, and the price paid for each kind or class; the total amount paid for materials, wages and cost of the work. Presented 2nd May, 1913.—*Mr. Hughes (Kings, P.E.I.)*.....*Not printed.*

203d. Return to an Order of the House of the 31st March, 1913, for a copy of all documents, papers, correspondence, representations, &c., relating to the purchase of land at Digby, Nova Scotia, for the purpose of a site for a public wharf. Presented 2nd May, 1913.—*Mr. Maclean (Halifax)*.....*Not printed.*

203e. Return to an Order of the House of the 19th March, 1913, for a return showing whether the repairs to Southport wharf, Lot 48, Prince Edward Island, have been completed; if the work was done by tender or by day labour; if by tender, with whom the contract was made; if by day labour, the number of superintendents, inspectors, or overseers employed, their names, the number of days each did work, and wages per day paid to each; the number of men employed, their names, the number of days each did work and the wages per day paid to each; who supplied the materials; the amount of each kind or class used and the price paid for each kind or class; the total amount paid for materials, wages and cost of the work. Presented 2nd May, 1913.—*Mr. Hughes (Kings, P.E.I.)*.....*Not printed.*

203f. Return to an Order of the House of the 11th December, 1912, for a copy of all accounts, correspondence, telegrams, complaints and other documents in possession of the Department of Public Works, in relation to the expenditure of moneys on harbour improvements at Grand Etang, during the year 1911-12. Presented 13th May, 1913.—*Mr. Chisholm (Inverness)*.. .. ..*Not printed.*

CONTENTS OF VOLUME 28.—*Continued.*

203*g*. Return to an Order of the House of the 7th April, 1913, for a copy of all documents, correspondence, &c., relating to the purchase by the Department of Public Works of a certain quantity of timber for the construction of a wharf at St. Germain de Kamouraska, the said purchase having been made, as alleged, from Murray Castonguay during the year 1912. Presented 26th May, 1913.—*Mr. Lapointe (Kamouraska).* *Not printed.*

203*h*. Return to an Order of the House of the 29th January, 1913, for a copy of all letters written to the Honourable Minister of Public Works, or to any officer of the Public Works Department, or to any member of the government since 10th October, 1911, by G. A. R. Rowlings, John S. Wells and S. R. Griffin, relating to the construction of public works, County of Guysborough, N.S., also a copy of the replies to the same. Presented 29th May, 1913.—*Mr. Sinclair*.....*Not printed.*

203*i*. Return to an Order of the House of the 7th May, 1913, for a copy of all correspondence exchanged between the Postmaster General and M. Isidore Belleau, of Quebec, in connection with improvements contemplated in Quebec harbour. Presented 2nd June, 1913.—*Mr. Carvell*.....*Not printed.*

203*j*. Return to an Order of the House of the 28th April, 1913, for a copy of all papers, documents, pay-rolls, receipts, accounts, correspondence, &c., relating to repairs made upon the breakwater at Petite Rivière, Lunenburg County, N.S., in the year 1912. Presented 6th June, 1913.—*Mr. Maclean (Halifax)*.....*Not printed.*

204. Return to an Order of the House of the 4th March, 1912.—1. For a copy of all reports of engineers from 1874 to 1900, relating to the most suitable site in the harbour of Quebec for the construction of a dry dock.

2. Of all correspondence exchanged on the subject of a choice of a site for the dry dock now existing at St. Joseph de Lévis, at the time of its construction.

3. Of engineers reports, plans, maps and bearings relating to the construction of a new dry dock in the port of Quebec since 1900.

4. Of all correspondence exchanged between the different companies and the government relating to the construction of a new dry dock in the port of Quebec, since 1909.

5. Also for the production of all documents submitted by the different companies who have asked for the government grant provided by the Dry Dock Subsidies Act. Presented 29th April, 1913.—*Mr. Béland*.....*Not printed.*

204*a*. Dry dock of Lévis. Report of Mr. Charles Smith against Sampson, et al.—(*Senate*). *Not printed.*

204*b*. Return to an Address to His Royal Highness the Governor General of the 19th March, 1913, for a copy of all orders in council, plans and estimates, correspondence, papers and inquiries respecting the construction of a dry dock at Quebec or Lévis or in the port or harbour of Quebec. Presented 6th June, 1913.—*Mr. Lachance*....*Not printed.*

205. Return to an Order of the House of the 9th April, 1913, for a copy of the petition of the Restigouche Fishermen's Association to the Minister of Marine and Fisheries asking for the removal of Mr. M. M. Mowat, head guardian of the Restigouche Riparian Association as Dominion fishery officer, and the answer thereto. Presented 2nd May, 1913.—*Mr. Marcil (Bonaventure)*.....*Not printed.*

206. Return to an Order of the House of the 13th February, 1913, for a return showing the name of the company who has the contract for the electric lighting of the government buildings and grounds in Ottawa, date of contract and period, on what notice can contract be cancelled, price paid per kilowatt hour for electric lighting, names of

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buildings lighted, cost of lighting each per year, rate for electric lighting if a combined power and light rate, price for current for power purposes, if lamps are not free, price paid for the carbon and tungsten lamps renewed, are lamps marked so as to be identified as belonging to the government buildings, number of electric lamp renewals paid for during the last fiscal year, where required, number of carbon and tungsten lamps respectively in use in the several buildings and the candle power or wattage of the same. Presented 2nd May, 1913.—*Mr. Wilson (Wentworth)*
Not printed.

207. Return to an Order of the House of the 17th February, 1913, for a copy of all correspondence, letters, telegrams, petitions, memoranda, reports, tenders, deposits, recommendations and all other documents of any nature whatsoever bearing on or having relation to the erection of a public building in the city of Three Rivers, P.Q., since the 11th day of October, 1911, to date. Presented 2nd May, 1913.—*Mr. Bureau.*
Not printed.

207*a*. Return to an Order of the House of the 26th May, 1913, for a copy of all papers, letters, and documents relating to the construction of a public building in the town of Laurentides, County of L'Assomption. Presented 4th June, 1913.—*Mr. Seguin.*
Not printed.

207*b*. Return to an Order of the House of the 2nd April, 1913, for a copy of all correspondence, letters, telegrams, contracts, tenders and reports of government inspector, in relation to the work and repairs on the public building at North Sydney during the year 1912, and particularly the inspector's report on the damages caused by fire during the construction of said works and repairs; and also a copy of the tenders of Henry Lovell, for the above work. Presented 6th June, 1913.—*Mr. McKenzie.*
Not printed.

207*c*. Return to an Order of the House of the 27th January, 1913, for a copy of all telegrams, letters, documents and plans relative to the purchase or acquirement of land for the purpose of erecting a public building in Stellarton, Nova Scotia, in the year 1912. Presented 6th June, 1913.—*Mr. Macdonald*.....*Not printed.*

208. Return to an Order of the House of the 24th February, 1913, for a return showing the names of the buildings occupied by the Government as public offices, which are under rent, excepting the Centre, East, West and Langevin Blocks; the street on which each of these offices is situated and the number of the street in each case. Presented 2nd May, 1913.—*Mr. Boulay*.....*Not printed.*

209. Return to an Order of the House of the 11th December, 1912, for a copy of all accounts, correspondence, telegrams, complaints and other documents in possession of the Department of Public Works, relating to the construction of telegraph lines during the year 1911-12, from South West Margaree to Scotsville, from Scotsville to North Ainslee; from Scotsville to South Lake Ainslee and Whycocomagh; from Little Narrows to Whycocomagh; from Rossville to Big Intervale and from Rossville to the Victoria County Boundary Line, all in the County of Inverness. Presented 2nd May, 1913. *Mr. Chisholm (Inverness)*.....*Not printed.*

210. Correspondence in connection with the area or areas prescribed for mange in British Columbia.—*(Senate)*.... .....*Not printed.*

211. Report made by the Central Railway of Canada to the Railway Department.—*(Senate).*
Not printed.

CONTENTS OF VOLUME 28.—*Continued.*

212. Return to an Address to His Royal Highness the Governor General of the 10th February, 1913, for a copy of all orders in council, letters, telegrams and of all other official documents of any kind in the possession of the Department of Customs, relating to the seizures of twenty horses from John Gobel, for smuggling them across the United States boundary near Coutts, or Writing-on-Stone, between the 20th and 28th of February, 1911. Presented 5th May, 1913.—*Mr. MacNutt*.....*Not printed.*

213. Return to an Address to His Royal Highness the Governor General of the 10th February, 1913, for a copy of all orders in council, letters, telegrams and of all other official documents of any kind in the possession of the Department of the Interior, relating to sale of school lands which have been held in the provinces of Alberta and Saskatchewan since the 12th day of October, 1911. Presented 7th May, 1913.—*Mr. McCraney*.....*Not printed.*

213*a*. Return to an Order of the House of the 2nd April, 1913, for a return showing by quarter-section, or fraction of quarter-section, all school lands sold in Manitoba, Saskatchewan and Alberta during the calendar year 1912; the price per acre at which each separate parcel was sold; the name and address of each purchaser; a list of all school lands sold at above sales which have since been cancelled; the price at which each parcel of said cancelled lands were sold, with the names and addresses of purchasers of each parcel of said lands sold and subsequently cancelled. Presented 23rd May, 1913.—*Mr. Turriff*.....*Not printed.*

213*b*. Return to an Order of the House of the 12th February, 1913, for a return showing all school lands sold in the province of Saskatchewan in 1912, giving each parcel of land sold, the name and address of each purchaser, the date and place of sale, the name of the auctioneer at each sale, and any assiguments of contracts of purchase of which the government has notice, and a copy of all correspondence passing between the Government, or any member thereof, and the Government of the province of Saskatchewan or any member thereof, with respect to the sale of school lands in the said province. Presented 6th June, 1913.—*Mr. Martin (Regina)*.....*Not printed.*

214. Return to an Order of the House of the 9th April, 1913, for a copy of all petitions, affidavits, specifications, plans, drawiugs, claims, certificates, papers and patent rights in the Department of Agriculture or the Patents Branch thereof, with respect to Patent Number 142823. Presented 7th May, 1913.—*Mr. Carvell*.....*Not printed.*

215. Return to an Order of the House of tho 28th April, 1913, for a copy of all memorials, petitions, and letters, addressed to or sent by the Minister of Agriculture, or on his behalf, in connection with the estab'ishment of an agricultural school, model farm or demonstration station at New Carlisle, Quebec. Presented 9th May, 1913.—*Mr. Marcil (Bonaventure)*.....*Not printed.*

216. Return to an Order of the House of the 28th April, 1913, for a copy of all telegrams, correspondeuce, returns, &c., between the Department of Agriculture, and any other person or persons, requesting recently that the Veterinary Director General of Canada visit Nova Scotia. Presented 9th May, 1913.—*Mr. Maclean (Halifax)*.
Not printed.

217. Extent to which the Franking privilege is used by the several provinces in Canada for statistics.—(*Senate*).....*Not printed.*

218. Return to an Order of the House of the 29th January, 1913, for a copy of all diaries and other documents relating to and showing the work performed during the months of June and July, 1912, by Homestead Inspectors Rathwell and Erratt in the Moosejaw land district. Presented 16th May, 1913.—*Mr. Knowles*.....*Not printed.*

CONTENTS OF VOLUME 28.—*Continued.*

218*a*. Return to an Order of the House of the 29th January, 1913, for a copy of all diaries relating to and showing the work performed during the months of June and July, 1912, by Homestead Inspectors Brandt, Balfour, Ouelette and Sipes, in the Regina land district. Presented 16th May, 1913.—*Mr. Martin (Regina)*.....*Not printed*

218*b*. Return to an Order of the House of the 29th January, 1913, for a return showing the expenses of Homestead Inspectors Brandt, Balfour, Ouelette and Sipes during the months of June and July, 1912. Presented 16th May, 1913.—*Mr. Martin (Regina)*. *Not printed.*

218*c*. Return to an Order of the House of the 29th January, 1913, for a return showing the expenses of Homestead Inspector Miller of the Moosejaw land district during the months of June and July, 1912, together with a copy of all reports, proceedings, diaries and other documents, showing the work performed during the said time by the said homestead inspector. Presented 16th May, 1913.—*Mr. Knowles*.....*Not printed.*

218*d*. Return to an Order of the House of the 29th January, 1913, for a copy of all diaries and other documents relating to and showing the work performed during the months of June and July, 1912, by Homestead Inspectors Shields and McLaren, in the Swift Current lands district. Presented 23rd May, 1913.—*Mr. Knowles*.....*Not printed.*

218*e*. Return to an Order of the House of the 29th January, 1913, for a return showing the expenses of Homestead Inspectors Shields, McLaren, Erratt and Rathwell, during the months of June and July of 1912. Presented 26th May, 1913.—*Mr. Knowles.* *Not printed.*

219. Return to an Order of the House of the 26th March, 1913, for a copy of all papers, memoranda, and instructions relating to a certain area of land on the bank of Little Manitou Lake, Saskatchewan, recently transferred to the town of Waterous, for park purposes. Presented 16th May, 1913.—*Mr. Oliver*.....*Not printed.*

220. Return to an Order of the House, of the 4th December, 1912, for a copy of all correspondence and other documents in the possession of the Department of Public Works relating to the proposed interprovincial bridge between Hawkesbury, Ontario, and Grenville, Quebec. Presented 26th May, 1913.—*Mr. Proulx*.....*Not printed.*

221. Return to an Order of the House of the 1st April, 1913, for a copy of all complaints, charges, evidence and reports in connection with the investigation held at Aldershot, N.S., in September, 1912, relating to the alleged thefts of property from the militia camp. Presented 26th May, 1913.—*Mr. Kyte*.....*Not printed.*

221*a*. Return to an Order of the House of the 21st April, 1913, for a copy of all notices, tenders, contracts and correspondence relating to the supplying of ice for the military comp at Aldershot, N.S., for 1913, and of all correspondence relating to the source of such ice supply. Presented 26th May, 1913.—*Mr. Kyte*.....*Not printed.*

222. Return to an Order of the House of the 17th February, 1913, for a copy of all letters, proposals, tenders, memoranda, papers and documents in the possession of the Department of Trade and Commerce, or any department of the Government, hearing date since 1st December, 1912, relating to steamship service between Canada and the West Indies. Presented 27th May, 1913.—*Mr. Maclean (Halifax)*.....*Not printed.*

222*a*. Return to an Order of the House of the 2nd April, 1913, for a copy of all correspondence, petitions, letters, telegrams, and other documents in the Department of Trade and Commerce, or any department of the Government, relating to the SS. service,

CONTENTS OF VOLUME 28.—*Continued.*

between Mulgrave, County of Guysborough and Cheticamp, Inverness County, during the years 1910-11, 1911-12, and 1912-13, and the service to be continued during the year 1913-14. Presented 27th May, 1913.—*Mr. Chisholm (Inverness)*.....*Not printed.*

223. Return to an Order of the Senate calling upon the Clerk of the House to furnish a statement showing the number of Bills passed by the House of Commons since Confederation, which have been:—1. Amended by the Senate. 2. Rejected by the Senate. 3. Amended by the Senate and accepted by the Commons.—(*Senate*).....*Not printed.*

224. Return to an Order of the House of the 14th May, 1913, showing whether a contract was passed by the Post Office Department in the year 1911, for the use of stamp vending machines, the terms of said contract, the date, and by whom signed. Presented 2nd June, 1913.—*Mr. Lemieux*.....*Not printed.*

225. Ordinances of the Yukon Territory, passed by the Yukon Council in the year 1913. Presented by Hon. Mr. Coderre, 2nd June, 1913.....*Not printed.*

226. Names of judges of Superior and Circuit Court in province of Quebec, date of appointment, &c.—(*Senate*).....*Not printed.*

227. Return to an Order of the House of the 19th May, 1913, for a return showing the per capita taxation for the year ending 31st March, 1913, and for each of the twelve preceding years. Presented 3rd June, 1913—*Mr. Hughes (Kings, P.E.I.)*....*Not printed.*

228. Return to an Order of the House of the 29th May, 1913, for a return showing whether a certificate has been issued by the Treasury Board authorizing the transfer of the assets and liabilities of La Banque Internationale du Canada to the Home Bank; the terms of the said transfer, and all documents bearing on this question. Presented 3rd June, 1913.—*Mr. Lemieux*.....*Not printed.*

229. Report of the Canadian delegates to the International Conference, held at New York for the consideration of the Commemoration of the First Century of Peace between the United States and the British Empire. Presented by Hon. Mr. Borden, 5th June, 1913.....*Not printed.*

230. Return to an Address to His Royal Highness the Governor General of the 10th March, 1913, for a copy of all correspondence, memoranda, orders in council, departmental orders and reports from fishery overseers or other officers, during the past two years, relating to weir licenses in the waters of the Counties of Charlotte and St. John, Province of New Brunswick. Presented 6th June, 1913.—*Mr. Pugsley*.....*Not printed.*

231. Return to an Order of the House of the 24th February, 1913, for a copy of all letters and papers relating to the issue of half-breed scrip, warrant No. 2155, certificate No. 672, to Albert St. Denis, and the disposition of the said scrip. Presented 6th June, 1913. *Mr. Oliver*.....*Not printed.*

232. Return to an Address to His Royal Highness the Governor General of the 3rd February, 1913, for a copy of all papers in connection with the withdrawal from settlement of a strip of land one mile in width along the line of the Hudson Bay Railway, and of the order in council, and also of all plans and correspondence in connection with the same, prior and subsequent thereto. Presented 6th June, 1913.—*Mr. Graham.* *Not printed.*

233. A return to an Order of the Senate dated 7th March, 1913, for a copy of all papers, letters, petitions, contracts and other papers relating in any way to the purchase of land at Le Pas for terminus of Hudson Bay road.—(*Senate*).....*Not printed.*

CANADA

COMPILED REPORTS

OF THE

INTERNATIONAL WATERWAYS COMMISSION

1905-1913

Submitted in Accordance with the Provisions of Chapter 36, Section 37, of the Revised Statutes of Canada.

PRINTED BY ORDER OF PARLIAMENT

OTTAWA
PRINTED BY C. H. PARMELEE, PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1913

[N° 19a—1913.]

To Field Marshal His Royal Highness Prince ARTHUR WILLIAM PATRICK ALBERT, *Duke of Connaught and of Strathearn, and Earl of Sussex, in the Peerage of the United Kingdom, Prince of the United Kingdom of Great Britain and Ireland, Duke of Saxony, Prince of Saxe-Coburg and Gotha; Knight of the Most Noble Order of the Garter; Knight of the Most Ancient and Most Noble Order of the Thistle; Knight of the Most Illustrious Order of Saint Patrick; one of His Majesty's Most Honourable Privy Council; First and Principal Knight Grand Cross and Great Master of the Most Honourable Order of the Bath; Knight Grand Commander of the Most Exalted Order of the Star of India; Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George; Knight Grand Commander of the Most Eminent Order of the Indian Empire; Knight Grand Cross of the Royal Victorian Order; Personal Aide-de-camp to His Majesty the King; Governor General and Commander-in-Chief of the Dominion of Canada.*

MAY IT PLEASE YOUR ROYAL HIGHNESS,—

I have the honour to lay before Your Royal Highness, Reports of the International Waterways Commission from 1905 to 1913.

I have the honour to be,

My Lord,

Your Excellency's most obedient servant,

ROBERT ROGERS,

Minister of Public Works.

OTTAWA, December 1, 1913.

This volume is a compendium of all memoranda and reports issued by the Canadian and American sections of the International Waterways Commission from their first appointment, in 1905, to the end of the calendar year 1913. It contains all the joint reports made, during the above mentioned period, by the full Commission of the Governments of Canada and of the United States.

Most of these memoranda and reports have already been published, but some are printed here for the first time. Many of those already published are out of print, but as there is a constant demand from various persons, companies and public bodies for complete information, it was considered advisable to issue this volume.

The stenographical notes of several public hearings held by the Commission on important questions and embodying information and data of the greatest value and for which there is also a constant demand from the general public, are included in this compendium.

Ottawa, December 1, 1913.

ERRATA.

Page 377—Instead of "this map is to be found at page 406," read: page 381.

Page 612—Appendix "D": instead of "see page 529," read: page 515.

Page 1074—Second line from top of page; instead of "see page...." read see page 775.

Page 1105—Second line from top of page; instead of "see page...." read: see page 354.

Page 1167—Second line from top of page; instead of "see page...." read: see page 515.

1905

FIRST PROGRESS REPORT OF THE CANADIAN MEMBERS OF THE INTERNATIONAL WATERWAYS COMMISSION

1905

International Waterways Commission,
Office of Canadian Section,
Ottawa, December 24, 1905.

Sir,—The Canadian section of the International Waterways Commission has the honour to submit the following progress report.

The River and Harbour Act, passed by the United States Congress and approved June 13, 1902, contained the following provision, viz.:—

'The President of the United States is hereby requested to invite the government of Great Britain to join in the formation of an international commission, to be composed of three members from the United States and three who shall represent the interests of the Dominion of Canada, whose duty it shall be to investigate and report upon the conditions and uses of the waters adjacent to the boundary lines between the United States and Canada, including all of the waters of the lakes and rivers whose natural outlet is by the River Saint Lawrence to the Atlantic ocean, also upon the maintenance and regulation of suitable levels, and also upon the effect upon the shores of these waters and the structures thereon, and upon the interests of navigation by reason of the diversion of these waters from or change in their natural flow; and, further, to report upon the necessary measures to regulate such diversion, and to make such recommendations for improvements and regulations as shall best subserve the interests of navigation in said waters. The said Commissioners shall report upon the advisability of locating a dam at the outlet of Lake Erie, with a view to determining whether such dam will benefit navigation, and if such structure is deemed advisable, shall make recommendations to their respective governments looking to an agreement or treaty which shall provide for the construction of the same, and they shall make an estimate of the probable cost thereof. The President, in selecting the three members of said commission who shall represent the United States, is authorized to appoint one officer of the Corps of Engineers of the United States Army, one civil engineer well versed in the hydraulics of the Great Lakes, and one lawyer of experience in questions of international and riparian law, and said commission shall be authorized to employ such persons as it may deem needful in the performance of the duties hereby imposed; and for the purpose of paying the expenses and salaries of said commission, the

Secretary of War is authorized to expend from the amounts heretofore appropriated for the Saint Marys river at the falls the sum of twenty thousand dollars, or so much thereof as may be necessary to pay that portion of the expenses of said commission chargeable to the United States.'

The invitation authorized by this section was duly communicated to the government of Great Britain by Honourable Jos. H. Choate, then American Ambassador in London, by a letter dated July 15, 1902 (copy appended, marked 'A').

On December 2, 1902, the invitation was transmitted by the Colonial Office in London to Lord Minto by a despatch dated December 2, 1902 (copy appended, marked 'B'), and by a subsequent letter dated December 3, 1902 (copy appended, marked 'C').

The Canadian government accepted the invitation of the United States government under the recommendation of the Honourable the Minister of the Interior, dated April 27, 1903 (copy appended, marked 'D').

On June 6, 1903, the Canadian government was informed by the Secretary of State for the Colonies that His Majesy's government had accepted the suggestion of the Canadian ministers in regard to the appointment of the Canadian Commissioners (copy of Mr. Chamberlain's letter appended, marked 'E').

The American members of the commission were appointed October 2, 1903. They were Colonel O. H. Ernst, Corps of Engineers, United States Army; Mr. George Clinton, attorney-at-law, of Buffalo, N. Y.; and Professor Gardner S. Williams, of Ithaca, N. Y.

The first appointed on the Canadian section was Dr. W. F. King, Dominion Chief Astronomer, of Ottawa, on December 3, 1903 (copy of order in council appended, marked 'F'). The two other Commissioners, Mr. James Pitt Mabee, K. C., of Toronto, and Mr. Louis Coste, C. E., of Ottawa, were appointed on January 7, 1905 (copy of order in council appended, marked 'G'). On February 20, 1905, Mr. Thomas Cote, of the city of Montreal, was appointed secretary of the Canadian section of the commission. He acted as secretary of the full commission up to the appointment by the United States government of Mr. L. C. Sabin, as secretary of the American section, on August, 1, 1905. On May 20, 1905, Mr. James P. Mabee was appointed president of the Canadian section of the commission (copy of order in council appended, marked 'H').

The Canadian section held its first meetings in Ottawa, Ont., on March 6 and 7, 1905. The scope of the investigations to be undertaken was defined in a letter addressed to each Commissioner and to the Secretary by the Honourable the Secretary of State for Canada, dated January 16, 1905 (copy appended, marked 'I'), from which the following is an extract:—

'Among the subjects that may come up for consideration before this commission are:

'1. The proposed diversion southward by the Minnesota Canal and Power Company, of Duluth, of certain waters in the state of Minnesota that now flow north into the Rainy river and the Lake of the Woods.

'2. The diversion about a mile and a half east of the town of Sault Ste. Marie of part of the waters of the St. Marys river into the Hay channel entirely through American territory. The River St. Marys now forms part of the boundary between the United States and Canada, and the waters of the river are clearly international. The Canadian vessels of necessity are using the Hay channel, but no treaty has been made concerning their right.

'3. Inquiry into the effect of the levels of Lakes Huron and Erie by the construction of the Chicago Drainage canal.

'4. The building of a dam and other obstructions on the St. John river flowing through the state of Maine into New Brunswick, contrary to the express stipulation of the Ashburton treaty'.

SESSIONAL PAPER No. 19a

The American section held its first meeting in Washington, D. C., on May 10, 1905, and organized by the election of Colonel O. H. Ernst as chairman. The scope of the investigations to be undertaken was defined in a letter from the Department of State, dated April 15, 1905 (copy appended, marked 'J'), from which the following is an extract:—

'The wording of the law will be seen by reference to the inclosed copy. The department's opinion is that the words "including all of the waters of the lakes and rivers whose natural outlet is by the River St. Lawrence to the Atlantic ocean" are intended as a limitation on what precedes them, and that the investigation and report should cover only such waters, omitting the lower St. Lawrence itself, as well as all other waters not discharging naturally through it.

'The broader interpretation given to the Act by the Canadian authorities should be rejected, if for no other reason, on account of the smallness of the appropriation for the support of the American section. Congress could hardly have intended to provide, with a sum of $20,000, for the expenses incident to an investigation extending to the Pacific coast, and possibly embracing the Alaskan boundary as well.'

Previous to the first meeting of the American section, it was learned that the United States government had placed upon the Act of Congress, authorizing the appointment of the commission, a construction limiting considerably the scope of the investigations to be undertaken.

By a despatch dated February 3, 1905 (copy appended, marked 'K'), the Canadian government, through diplomatic channels, made representations to Washington in regard to the erection of further piers in the St. John river. On February 24 the United States Secretary of State informed the Canadian government, through His Majesty's Ambassador in Washington, Sir H. M. Durand (copy of Sir H. M. Durand's despatch and copy of Mr. John Hay's letter appended, marked 'L' and 'M,' respectively), that the commission was debarred from investigating the case of the St. John river and making a report thereon.

On March 25, 1905, the Canadian government made further representations to the United States government (copy of order in council appended, marked 'N'), from which the following is an extract:—

'The minister further observes that throughout the correspondence which has taken place prior to the appointment of the Canadian section of the commission, the terms used have always been identical to those of the Act above referred to (the River and Harbour Act approved June 13, 1902), and that it has always been understood that the investigations would bear upon the conditions and uses of the waters adjacent to the boundary line between Canada and the United States, the other waters belonging to the lakes and rivers whose natural outlet is by the River St. Lawrence to the Atlantic ocean being stated to be also included therein, but the general scope of the commission being especially intended to apply to all waters adjacent to the boundary line between Canada and the United States.

'The minister, therefore, is of the opinion that in the despatch under his consideration an unintentional misapprehension has existed as regards the term of the Act of Congress, and that it is fit and proper that the work of the commission be not restricted to narrower limits than those indicated by the said Act.

'The minister, therefore, recommends that the necessary representations be made in order that the investigation to be carried on by the said commission, and the report to be based thereon shall extend to all the waters adjacent to the boundary line between Canada and the United States, and, therefore, include such portions of the St. John river as will come within the limit assigned by the Act of Congress to the work of the commission.'

In the meantime, the American section at its meeting, held on May 10, had decided to invite the Canadian members to join in the first full meeting of the commission in Washington, D.C., to be held May 25, and an invitation was issued accordingly by the Department of State at the request of the Secretary of War. On May 25 the full commission held its first meeting in Washington and organized by the election of Colonel Ernst as chairman of that meeting, it being agreed that at meetings of the full commission held on American territory, the chairman of the American section should preside, and at meetings held on Canadian territory, the chairman of the Canadian section should preside. The Canadian members paid a visit of courtesy to President Roosevelt, where the scope of the investigations was formally discussed. The full commission also proceeded in a body to call upon the Secretary of State.

The commission remained in session during the 25th and the following day, discussing the organization, permanent places of meeting, and scope of their duties. It was decided that for the present the offices of the Canadian section should be established in Toronto, and those of the American section in Buffalo, and that full meetings should be held in one or the other city, as should be found most convenient. Subsequently, however, the Canadian section decided to establish its permanent quarters in the city of Ottawa, not having been able to find in Toronto, at any reasonable price, suitable offices. It was also found more convenient to establish the Canadian offices of the Commission right at the seat of the Government.

The American section having presented the instructions under which they were acting, quoted above, the president of the Canadian section, Mr. J. P. Mabee, presented the following memorandum:—

'The Canadian members of the International Waterways Commission had understood the scope of the commission to be wider than the American members regard it, and that misunderstanding may be avoided, desire briefly to state the position they have understood matters to be in.

'The invitation of His Majesty's government, through the American Ambassador in London, was "for the appointment of an international commission to be composed of three members from the United States and three who shall represent the Dominion of Canada, whose duty it shall be to investigate in general the waters adjacent to the boundary line between the United States and Canada, the effect upon the shores produced by changes in the water levels, and the erection and location of a dam at the outlet of Lake Erie."

'In due course by a report of the Committee of the Privy Council of Canada, approved by the Governor General of Canada, it was resolved "that His Majesty's government accept the invitation to co-operate in the formation of the commission," this report, after further reciting that as the subjects to be dealt with pertained to "the regulations of the waters adjacent to the international boundary," the matter in so far as Canada was concerned should be under the Department of the Interior and the Department of Public Works.

'Some regrettable but unavoidable delay in completing the Canadian section of the commission arose by the long-continued illness of the Honourable the Minister of Public Works for Canada.

'In the despatch to the government of Great Britain, naming the American Commissioners, the invitation to His Majesty's government is again recited as being one to form an "international commission to investigate and report upon the conditions and uses of the waters adjacent to the boundary lines between the United States and Canada."

'After the appointment of the Canadian Commissioners, the Prime Minister of Canada, Sir Wilfrid Laurier, in communicating the matter to the Canadian House of Commons in January last, dealt with the subject-matter of the commission as covering all waters adjacent to the boundaries of the two

countries, and in the course of his speech made the following statements: "In sections of the country where the boundary is not water, but land, there are streams and large rivers which have their sources in one country and which flow into another. Complaint has been made by the United States that Canadians have constructed some works upon rivers which have their sources in Canada and which flow into the United States, and that these works affect the flow of the waters in their country. We also have made complaints to the United States that Americans have constructed upon some rivers, the St. John river, for instance, works which affect the flow of the waters in our country. It is, therefore, to the mutual interest and advantage of both countries to have this question properly investigated with the view of having concurrent legislation, if such should be found necessary. From olden times it has been a principle of Roman law, which has been adopted by most civilized nations, that the riparian owner of any stream has the right to use the water of that stream for his own benefit, provided he does not impair the flow of the water beyond the boundary of his property. This is a principle of law which dominates in almost every country; but it is not possible to have this principle followed and carried out when the works are in one country and the boundary of the property is in another country. For these reasons we have thought it advisable to respond to the invitation of the United States to have this question investigated. We have agreed to a commission, to be composed of six members, three to represent the government of the United States and three to represent the government of Canada."

'If the inquiries of the commission are to be limited to the waters of the Great Lakes only, it would seem that the government of Canada has been under a misapprehension as to the desires and intentions of the government of the United States, and we regard it as our duty to report to our government the limitations expected to be placed upon the scope of the commission, and we respectfully suggest that further action should be delayed until we may be advised of the views of the government of Canada upon the premises.'

This was concurred in by the two other Commissioners, Dr. W. F. King and Mr. Louis Coste.

The chairman of the American section stated that he was informed that the British government had communicated with the American government, through diplomatic channels, requesting that a broader interpretation be given to the Act of Congress providing for the commission, and that the American government then had the matter under consideration, but that no decision could be taken before the return to Washington of the United States Secretary of War, at the time absent in the State of Ohio. It was then decided that further proceedings be deferred until further instructions be received from the two governments. It was agreed that the decision of the American government should be communicated to the chairman of the Canadian section as soon as received, and that if it be favourable to the Canadian interpretation of the law, or if it be unfavourable and be accepted by the Canadian government, then a meeting of the commission should be called on Canadian territory by the chairman of the Canadian section at as early a date as practicable. The result of this meeting was communicated to His Majesty's Ambassador at Washington by the secretary of the Canadian section, and Sir H. M. Durand and Mr. H. O'Beirne, the British charge d'affaires, had interviews with Secretary of War Taft and Acting Secretary of State F. B. Loomis, urging the contention of the Canadian government as set forth in the order in council of March 25, 1905, above quoted.

The United States government persisted in its interpretation of the Act of Congress, and His Majesty's Ambassador in Washington was so informed by the Acting Secretary of State, F. B. Loomis, in a letter dated May 31, 1905 (copy appended, marked 'O').

On June 2, the acting Minister of Public Works, Honourable W. S. Fielding, was informed by the secretary of the Canadian section of what had happened in Washington (copy of the memorandum appended, marked 'P').

On June 5, 1905, the following instructions were given to the Canadian section by the Right Honourable Sir Wilfrid Laurier:—

PRIME MINISTER'S OFFICE, CANADA,
OTTAWA, June 5, 1905.

'DEAR SIR,—With reference to the objection raised by the American Commissioners to consider any other waters than the waters of the lakes and rivers whose natural outlet is by the River St. Lawrence to the Atlantic ocean, it would be of no use to persist in our contention, and the government, therefore, are of opinion that the Commissioners had better proceed even in this limited way.

'At the same time, the Canadian Commissioners would do well to call the attention of the commission to the condition of things which exists on the River St. John, and the necessity of prompt joint action thereon.

'Yours very sincerely,

WILFRID LAURIER.

'THOMAS CÔTÉ, ESQ.,
'Secretary, Canadian Section,
'International Waterways Commission,
'Ottawa.'

In the meantime, the decision of the United States government had been communicated to the president of the Canadian section by a letter dated June 2, 1905 (copy appended, marked 'Q'). The chairman of the Canadian section communicated to the chairman of the American section the decision of the Canadian government, authorizing the Canadian members to proceed with the work of the commission within the field prescribed to the American members (see letter copy appended, marked 'R').

The Canadian section then proceeded to complete its organization. Through the courtesy of the Honourable the Minister of Public Works, temporary quarters in the Seybold building, in Ottawa, were assigned to its use, and later on, permanent quarters were procured in the Corry building. The American section, on the other hand proceeded also to complete its organization, establishing its quarters in the Federal building in Buffalo. Mr. L. C. Sabin, the secretary of that section, took charge of the office on September 11, 1905.

The full commission held its second meeting at Toronto, June 14 and 15, 1905. It was learned then that Professor Williams had tendered his resignation as member of the commission, and had been replaced by Mr. George Y. Wisner, C.E., of Detroit, appointed June 8, 1905. Among the questions brought to the attention of the commission at this meeting were the following, viz.:—

'A. The uses of the waters at Sault Ste. Marie for power purposes, and the regulations necessary to insure an equitable division of the waters between the two countries and the protection of the navigation interests.

'B. The uses of the waters of the Niagara river for power purposes, and the regulations necessary to insure an equitable division of the waters between the two countries and the protection of Niagara falls as a scenic spectacle.

'C. The alleged differences in the marine regulations of the two countries with respect to signal lights, and the advisability of adopting uniform signals for both countries.

'D. The advisability of building controlling works at the outlet of Lake Erie, including the effect upon the levels of the lakes and upon their shores, and upon the River St. Lawrence.

'E. The diversion southward by the Minnesota Canal and Power Company, of Duluth, of certain waters in the state of Minnesota that now flow north into the Rainy river and the Lake of the Woods.

'F. The effect of the Chicago Drainage canal upon the levels of Lakes Michigan, Huron, Erie and Ontario, and upon the River St. Lawrence.

'G. Delimiting the international boundary on the international waterways and delineating the same on modern charts.

'H. The suppression or abatement of illegal fishing on the Great Lakes.

'I. The location and construction of common channels.

'J. Regulations to govern navigation in narrow channels.

'K. Protection of shores from damage due to deepening of channels and increased speed.

'L. The transmission of electric energy generated in Canada, to the United States, and vice versa.'

The questions more specially dealt with at the meetings of the commission, on June 14 and 15, in Toronto, were the construction of regulating works at the outlet of Lake Erie, and their probable effect on Lake Ontario and on the River St. Lawrence; the uses of the waters of Niagara river for power purposes, and the preservation of the falls; and the proposed works of the Minnesota Canal and Power Company, which were referred to the committee on jurisdiction, composed of the attorneys of the two sections, and also to the engineering committee, composed of Messrs. George Y. Wisner and Louis Coste.

In view of permitting the commission to make its existence known to the persons most interested in the international waterways, so as to receive suggestions from them, and to visit in person some or all of the principal localities concerned, it was decided to give public hearings where such hearings were desired by the local business interests.

On July 7, the commission in a body paid a visit of courtesy to the Canadian government at Ottawa, and were the recipients of many delicate attentions from the authorities. The relation of the public functions connected with that meeting is appended marked 'S'. Between July 9 and 13, the commission passed over the St. Lawrence river and the Canadian canals from Quebec to Kingston using the government steamer *Frontenac*, kindly placed at their disposal by the Honourable Raymond Préfontaine Minister of Marine and Fisheries. (See appendices 'Sa,' and 'Sb.' Public hearings were held at Montreal, July 11, at Kingston, July 13, at Niagara Falls, September 14, at Toronto, September 15, at Hamilton, September 16, and at Buffalo, November 10. At the first hearing in Montreal, strong objections were presented by the commercial and shipping interests against the proposed construction of controlling works at the outlet of Lake Erie, in fear that such works would be detrimental to the navigation of the St. Lawrence river, and more especially to the St. Lawrence ship channel from Montreal to Quebec. It was then emphatically stated by the American members of the Commission that no plan had yet been prepared for the proposed works, and if said works were to cause injury to the River St. Lawrence, the proposition would be entirely and absolutely rejected. (See appendix "Sc").

The same expression of opinion was given at the public hearings held in Kingston, Toronto, Hamilton, Niagara Falls, and Buffalo. (See appendices "Sd", "Se", "Sf" and "Sg.")

During the month of August a committee of the members of the commission visited the Detroit river, the St. Clair river, Lakes St. Clair and Huron; St. Marys

river, Sault Ste. Marie; Lake Superior; Port Arthur, Fort William and their surroundings; Duluth, Minneapolis, St. Paul, Chicago and Detroit. The report of the subcommittee who made this investigating trip is appended, Marked 'Z'.

Meetings of the full commission were also held at Buffalo on September 11, 12 and 13, October 27 and 28, and November 10 and 11. To enable all interested persons to appear before the commission, or to address it, it was arranged that public notice of all meetings would be given as long in advance as possible through the press of the principal cities on both sides of the Great Lakes and the St. Lawrence river.

SAULT STE. MARIE.

Of all the questions brought to the attention of the commission the most pressing one for consideration was that relating to the uses of water at the Sault Ste. Marie. The situation there, in brief, is this:—

The volume of water flowing out of Lake Superior is, at normal low water—elevation 601—about 64,000 cubic feet per second. Lower stages and a lower discharge have sometimes occurred. On either side of the rapids is a navigation canal, constructed by the United States and Canadian governments, respectively.

The traffic through these canals has reached enormous proportions and is increasing. It is larger this year than ever before, and will greatly exceed 40,000,000 tons for the year. The quantity of water consumed in the operation is about 1,200 cubic feet per second. The quantity required in the future will be greater. Not less than 4,000 cubic feet should be unconditionally reserved for canal uses, and in granting power privileges the respective governments should not forfeit the right to increase the amount indefinitely. It may be remarked in passing that raft navigation over the rapids has so greatly diminished, and is now so small in amount, that the quantities of water above mentioned will suffice to provide for it. This leaves about 60,000 cubic feet which may be temporarily used for power purposes.

On the Canadian side the Lake Superior Power Company has a power canal in operation, which has a capacity of about 9,000 and is using about 7,000 cubic feet per second. This company has designed an additional canal, not yet constructed, which will have a capacity of about 23,000 cubic feet per second. On the American side the Michigan Lake Superior Power Company has in operation a power canal, which has a capacity of about 31,000, and is using about 3,500 cubic feet per second. This canal takes the water from the St. Marys river above the rapids, conducts it through the city of Sault Ste. Marie, and empties it about a mile below the rapids. On the American side also the Chandler-Dunbar Company, owning a portion of the shore line adjoining the rapids, have in operation power works using about 1,400 cubic feet per second. This company is engaged in altering and improving its works in the bed of the stream, under revocable permits from the United States department of war.

Under permits thus far granted, the consumption of water will be increased to about 3,000 cubic feet per second, but in March, 1902, the company applied for a permit to build a dike downstream from the fourth pier, counting from the American side of the International bridge in a direction nearly parallel with the shore, to connect with a power house extending out an equal distance into the stream. A rival company, the St. Marys Power Company, applied in March, 1903, for permission to construct a power canal by means of two parallel dikes extending downstream and a short distance upstream, from the third and fifth piers of the bridge, with corresponding power-house. Neither of these latter requests were granted, but they show what the intentions of the companies are, if they be permitted to carry them out. Evidently there is not enough water to carry out all of these schemes. An understanding must be reached by which

there shall be an equitable division of the surplus water betweem the two sides of the boundary. The division between rival companies, fortunately for this commission, may be left to the courts of law.

The figures above quoted for the Chandler-Dunbar Power Company represent 700 cubic feet per second being actually used, and 700 cubic feet per second being wasted.

The application to the War Department of the United States from the American companies for further privileges, and from the Lake Superior Power Company to the Canadian government for additional authority, led the commission at its session of October 28 to pass the following resolution, of which copies were sent to the Secretary of War of the United States and the Minister of Public Works for Canada, viz.:—

'Resolved, that in the opinion of this commission, no further rights or privileges should be granted or conferred regarding the uses or diversions of the water flowing out of Lake Superior, by either the government of the United States or Canada, until all data and information are in the hands of the commission that may be necessary to enable it to make suggestions for regulating the excess of these waters, or that, if such rights or privileges be granted, they be subject to any regulation that may be adopted by both governments.'

This resolution was transmitted to the Lieutenant-Governor of Ontario by the Secretary of State for Canada, upon a report of the Privy Council (copy appended, marked 'T').

The use of water in St. Marys river for power purposes must be so regulated as not to affect injuriously the level of Lake Superior. The level must never be allowed to fall so low as to injure navigation, and it must never be raised so high as to submerge the shores.

The Act of Congress, approved on June 13, 1902, authorized the Michigan Lake Superior Company to divert water from St. Marys river, above the rapids, with certain conditions which are described as follows in the act, viz.:—

'Subject to the express precedent conditions hereinafter mentioned, the Michigan Lake Superior Power Company, of Sault Ste. Marie, Michigan, its successors and assigns, after first obtaining consent of the Secretary of War and the Chief of Engineers and their approval of the said canal and remedial works proposed, is hereby authorized to divert water from the Saint Marys river into its water-power canal now being constructed at Sault Ste. Marie, Michigan, for water-power purposes while and so long as such works and diversion of water from said river shall not injuriously affect navigation therein, nor impair or diminish the water levels or any natural increase thereof either in Lake Superior or in the United States ship canal and locks or the navigable channels, locks or ship canals connected therewith, whether natural or artificial, now existing or which may hereafter be established or created by the United States for navigation purposes. And conditioned further, that said company shall establish, maintain and operate suitable and sufficient remedial and controlling works in the rapids of said river, to the approval of the Secretary of War, and the Chief of Engineers; and the said company shall maintain and operate said canal and works in accordance with any rules and regulations that may hereafter be recommended by any international commission and that shall become operative. Whenever, in the judgment of the Secretary of War, the operation of said canal and remedial and controlling works, or either of them, either in themselves or in conjuction with any other canal or canals in the United States or Canada which now or hereafter may exist, is injuriously affecting water levels or the navigation of Lake Superior, the River Saint Marys or other channels, locks or ship canals connected therewith as hereinbefore provided, he shall impose upon said company such rules and regulations for the operation of said canal and remedial works, as may, in his opinion, be necessary to prevent such injury. It shall become his duty, and he

shall have the authority to enter upon the property of said company and to close said canal in whole or in part to the extent necessary to maintain water levels and to require said company, at its own expense, to remove, add to or modify said works or any part thereof to the extent necessary to maintain water levels. Neither the Secretary of War nor the Chief of Engineers or any officer or other person acting under direction of them or either of them, shall be in any way liable by reason of anything done in the execution of this provision.

'All remedies herein provided, however, shall be cumulative, and shall be without prejudice to any other remedies, either of the United States or of individuals, for failure of said company to maintain said levels for navigation purposes as herein provided.

'Nothing herein contained shall be held to affect any existing riparian or other rights of any person or corporation, or the existing remedies therefor, or any action at law or equity now pending. The right is hereby expressly reserved to Congress to alter, amend or repeal the provisions contained in this paragraph.'

The United States War Department entered into an agreement with the Michigan Lake Superior Power Company (copy of which is appended, marked 'U'), and imposed upon the company certain rules and regulations to govern the maintenance of the level of Lake Superior. In the legislation above quoted and in the agreement referred to, the principle was recognized that the use of the water of St. Marys river for power purposes was not granted in any fixed quantity nor for any fixed length of time. It was further recognized that the Secretary of War could enter upon the property and close the canal of the company, in whole or in part, at any time to the extent necessary to maintain the level of S. Marys river above the rapids. The Act further stated that the use of the water of St. Marys river should finally be regulated by an international commission. The rules and regulations imposed upon the Michigan Lake Superior Power Company by the Secretary of War on December 2, 1902, are still in force and will probably be used by the International Waterways Commission as a foundation in framing the regulations to be ultimately recommended to the government of Canada and to the government of the United States. The fundamental principles on which these rules and regulations are based are:—

1. Levels must be maintained.
2. Navigation must be protected.
3. The public must reserve the right to use any portion or all of the natural flow in the future.

A public hearing, at which the parties interested in the condition of affairs at Sault Ste. Marie were given an opportunity to be heard, was held in Buffalo on November 10. The Lake Carriers' Association appeared before the commission and made a strong plea in favour of reserving the land north of the Poe lock for the construction of an additional ship canal and locks. (See appendix "U".

The commission, at its session of November 11, practically adopted certain rules and regulations to govern the use of the water at St. Marys river and the maintenance of the level of that river above the rapids, and it is hoped that said rules and regulations can be forwarded to the United States Secretary of War, and to the Minister of Public Works of Canada, for approval at an early date. The enforcement of these rules and regulations calls for executive action from time to time, and in this regard the American section of the commission, in its progress report to the Secretary of War, suggested that said executive action be vested in an international commission. Here follows the suggestion of the American section:—

'The enforcement of these rules and regulations calls for the executive action from time to time of an international commission. The enforcement

of rules to be established hereafter at other places or upon other subjects will probably likewise require joint executive action. It is not clear from the language of the law creating this commission that congress intended to provide for a permanent international board. It is desirable that the status of the present commission as a permanent executive board be defined, or a new board created.'

The questions brought to the attention of the commission enumerated above cover a wide range of subjects. Some of them clearly come under the jurisdiction of the commission as constituted and as limited in its scope by the United States government. Some do not, if the opinion of the United States Attorney General is to prevail, come under the jurisdiction of the commission, whilst about others there is room for doubt. The American section, in the progress report made to the United States War Department has suggested that the jurisdiction of the commission be more clearly defined.

The United States Secretary of War, in his annual report to President Roosevelt, dated December 9, 1905, has approved the suggestions of the American section in this regard. Here is what he states at pages 51 and 52 of said report:—

'The full commission has held numerous meetings and public hearings, in both the United States and Canada, and has collected a large amount of data bearing upon the various questions which have been brought to its attention. A progress report, showing the work that has been accomplished, is attached hereto marked Appendix F, and attention is invited to this report for a full and detailed statement of the labours of the commission.

'It has been hampered in its work by a lack of clear understanding as to its permanency and as to the eventual scope of its duties. For example, in making regulations for the uses of the surplus waters at the Sault Ste. Marie for power purposes, it seems necessary to provide for joint continuous supervision. The enforcement of rules to be established hereafter at other places or upon other subjects will probably likewise require joint executive action. It is not clear from the language of the law creating the commission that Congress intended to provide for a permanent international board. It is desirable that the status of the present commission as a permanent executive board be defined or a new board created.

'The questions which have been brought to the notice of the commission by various persons or interests thus far cover a wide range of subjects. Some of these questions clearly come under the jurisdiction of the commission as constituted, while some clearly do not, and about others there is room for doubt. The Canadian members of the commission are ready and anxious to consider all of these questions and to extend the jurisdiction of the commission to all international waters between the Atlantic and the Pacific oceans. It is desirable that the wishes of Congress in this matter be more defined.'

Since the commission completed its organization, it has made good progress in the collection of data bearing upon some of the questions brought before them, particularly upon those relating to the uses of the waters of the Niagara river for power purposes; the regulation of the level of Lake Erie by works near its outlet, and the proposed works of the Minnesota Canal and Power Company.

NIAGARA FALLS.

With reference to the uses of the waters at Niagara Falls, although the commission was not ready to report, it thought proper to pass, at its session of

October 28, the following resolution, of which copies were sent to the Secretary of War of the United States and to the Minister of Public Works of Canada, viz.:—

'Resolved, that this commission recommend to the government of the United States and Canada that such steps, as they may regard as necessary, be taken to prevent any corporate rights and franchises being granted or renewed by either federal, states or provincial authority for the uses of the waters of the Niagara river for power or other purposes until this commission is able to collect information necessary to enable it to report fully upon the "condition and uses" of those waters to the respective governments of the United States and Canada.'

This resolution was transmitted by the Secretary of State for Canada to His Honour the Lieutenant-Governor of Ontario, and by the United States Secretary of War to the Governor of the State of New York.

The Canadian section requested Monseignor J. C. K. Laflamme, the eminent professor of geology at Laval University, Quebec, to make a special report on the geological condition of the bed of the river in the vicinity of the falls. His report is appended, marked 'V'.

The situation at Niagara in brief is this:—

The following quantities of water are required for chartered developments in operation or in course of construction on both sides of the river:—

On the Canadian side—

The Ontario Power Company	12,000	cubic feet per second.
The Electrical Development Company	10,600	" "
The Canadian Niagara Power Company	9,500	" "
Total	32,100	

On the American side—

The American Niagara Falls Power Co.	17,200	cubic feet per second.
The Niagara Falls Hydraulic Power and Manufacturing Company	9,200	" "
Total	26,400	

Total on both sides, 58,500 cubic feet per second.

It is estimated that the total flow over the two falls is 222,400 cubic feet per second. There remains to be determined to what extent the use of 58,500 cubic feet per second for power purposes by the present companies, on both sides of the river, will affect the American fall. A competent hydraulic engineer, at the request of Dr. Clarke, the geologist of the State of New York, has calculated that the subtraction of 40,000 cubic feet per second from the Niagara river above Goat island will draw the water down to the rock bottom edge of the American fall, leaving a miserable little film dribbling over the sill; and that the subtraction of 40,000 cubic feet more, or 80,000 cubic feet per second in all above Goat island, will dry up the American channel completely, while the Canadian channel will still be an object of interest. Does this necessarily mean that the using of more water on the Canadian side, assuming that said water is taken below the crest of the rapids, will also affect the American fall? This is a point to be determined.

According to the Niagara Falls Electrical hand book, the height of the Canadian fall, over which flows about seven-eights of the entire volume of water, is 159 feet. The height of the American fall is 165 feet, or about six feet greater than that of the Horseshoe fall, the difference in the level being caused by the greater declivity in the bed of the river in the Canadian channel.

The official geologist of the State of New York states that the height of the American fall is by ten feet greater than the Horseshoe fall. Other engineers and experts have put the difference to from twelve to fourteen feet. This point should also be determined.

The slope of the Niagara river towards the Horseshoe fall is such that the level in the vicinity of the intakes of the power plants on the American side is considerably higher than the Horseshoe fall, towards which the water flows down as in a steep recipient. The American fall is barred off on this channel by a reef near the head of Goat island. The form of the Niagara river is such, however, that it spills over the side of the draw leaving to the Horseshoe fall and branches the water which flows over the American fall. It is clear that the drawing of water from the American side must have a greater effect upon the lower end of the American fall than drawing it on the Canadian side, two of the Canadian intakes being below the crest of the rapids. The data are lacking regarding the speed of this descent, hence it is not possible to estimate with any accuracy what are the relative amounts of water which can be drawn from the two sides of the river without affecting the American fall. *En resumé*, we have no absolute data to govern us at the present time.

Besides the chartered developments referred to above, there are in existence two charters granted by the New York legislature to corporations organized to take unlimited water from Niagara river.

The Dominion Parliament has also granted charters to three corporations which are still in force and organized for the purpose of diverting water from the Welland river or from the Niagara river by back flow, and from Grand river and Lake Erie.

None of these companies on either side of the river have actually commenced the construction of their works.

At Chicago, citizens of the United States have built a drainage canal, which, when fully completed, will use 10,000 cubic feet of water per second. This drainage canal will have the effect of lowering Lake Michigan by over six inches and Lake Erie by nearly four inches. It will, beyond a doubt, materially affect the flow of the Niagara river over the falls.

On the Canadian side there is also the Welland canal and the Hamilton Cataract Power Company, who take their water from the Welland canal, using the escarpment at De Cew's fall and representing a total diversion of 2,400 cubic feet per second.

There is also the Niagara Falls Park River Railway Company, who are using 1,500 cubic feet of water per second.

On the American side another diversion of 1,500 cubic feet per second is made by way of the Erie canal.

Therefore the total diversions of water by works in operation or under actual construction on the American side represent 37,900 cubic feet per second, and on the Canadian side the total quantity of water which will be ultimately diverted by works actually in operation or in way of construction represent 36,000 cubic feet per second.

President Roosevelt, in his message to congress on December 5, 1905, stated as follows:—

'In my judgment, the Grand Canyon of the Colorado should be made into a national park. It is greatly to be wished that the state of New York should copy, as regards Niagara, what the state of California has done as regards the Yosemite. Nothing should be allowed to interfere with the preservation of Niagara falls in all their beauty and majesty. If the state cannot see to this, then it is earnestly to be wished that she should be willing to turn it over to the National government, which should in such case (if possible, in conjunction with the Canadian government) assume the burden and responsibility of preserving

unharmed Niagara falls; just as it should gladly assume a similar burden and responsibility for the Yosemite national park, and as it has already assumed them for the Yellowstone national park. Adequate provision should be made by congress for the proper care and supervision of all these national parks.'

Your commission are desirous of obtaining the views of the government as to preserving the scenic beauty of Niagara falls.

No doubt the government of the province of Ontario will be ready to co-operate with the Dominion government in this regard. An agreement will have to be arranged whereby the quantity of water diverted for power or other purposes shall be limited, and there will have to be an arrangement for equitable division of such waters. The demand for use of power for commercial purposes will increase every year, and it will require a very strong stand to prevent the despoiling of this one of nature's greatest wonders.

The Federal government has, in the opinion of this commission, control of the deportation of power to the United States. Unfortunately, a very large portion of the power generated on our side of the river at Niagara will, unless some more effectual restrictions are placed upon its removal, soon be permanently diverted to the building up of American factories and the running of American railways. Within a few years our own railways will be clamouring for this power. Vested rights already interfere with action in this regard, and the more power that is now allowed to be diverted the greater will be the evil and the harder to rectify.

It is quite evident, in the view of the commission, that the jurisdiction to deal with international waters must be vested in the Federal government of each country. Changed conditions and the greatly increased demand for power, owing to electrical developments, have rendered it absolutely essential that there should be one authoritative body controlling the diversion of such waters. The interests of navigation must be paramount, and the Federal government alone must ultimately decide what those interests are. The maintenance of Niagara is a national matter, and should be dealt with on national lines.

The whole question of riparian rights in relation to navigable streams or international waters will most likely have to be adjusted by some treaty arrangement between the two countries, and instructions will have to be given to some commission to report upon some scheme of settlement upon broad lines.

It is desirable to have settled by the highest authority as soon as possible, whether the water in navigable international streams is in any sense the property of the provinces or states bounding on the same, or whether whatever property rights exist in such streams are vested in the Federal government. If it should be held that the provincial and state authorities have proprietary rights in such waters, then your commission are of the opinion that some arrangements should be made with the provinces by which such rights should be acquired, so that the use of the same may be the subject of a reasonable treaty of mutual benefit with our neighbours.

RAINY RIVER.

The proposed works of the Minnesota Canal and Power Company are of vast importance to the Rainy river district. They may be described as follows:—

At the height of land in St. Louis and Lake counties in northern Minnesota, the waters from Birch lake and White Iron lake, and the streams running out thereof, and the immense watershed thereof, run northward and ultimately into Rainy lake, and from there into Rainy river, passing into the Lake of the Woods. The water from this source forms by computation seven per cent of the water passing out of Rainy lake over Alberton falls at Koochiching. The water system of Rainy river and Lake of the Woods have long been established

as a commercial highway. From the Canadian ports of Rat Portage and Fort Francis, two large and well equipped passenger and freight lines ply daily during the season of navigation, forming the means of water communication between the Canadian ports of Rat Portage, Rainy River town, Boucherville, Burwick, Emo, Big Forks, Little Forks, Isherwood, Fort Francis, Bears Pass, Seine River and Mine Centre, and forming along a considerable part of such route the only vehicle of passenger and freight communication.

The most important section of the two hundred miles of navigation is the Rainy river, flowing through what is rapidly becoming a thickly populated and prosperous valley for some eighty odd miles, with towns rapidly building up at close intervals on its banks dependent almost wholly on the river route for their mercantile and manufaturing interests. The fine class of steamboats plying on this water is already in certain portions of the summer hampered by low water on the rapids and shoals of the river, and the proprietors of the regular steamboat lines have been earnestly petitioning for such improvement being made on the river as would remove such disability, a disability that compels the withdrawal for considerable intervals during each summer of some of the large and deeper draught steamboats. In view of the fact that navigation is already suffering for lack of adequate water in portions of Rainy river and in portions of Rainy lake, the population of that district has learned with surprise and alarm that active steps had been taken by the Minnesota Canal and Power Company, of Duluth, Minn., to obtain the authorization of the Federal government of the United States, through the Commissioner of the General Land Office at Washington, to construct a dam or dams and a canal to divert all the waters of the Birch lake and White Iron lake watershed, hereinbefore referred to, into the Embarrass river, and by it into Lake Superior at Duluth, thus diverting from this long established international waterway of Rainy lake and Rainy river a large proportion of its tributary waters. It is claimed that, if permission be given by the Federal government of the United Satates to the project of the Minnesota Canal and Power Company, a disastrous injustice will be done to Canadian and American established navigation companies that are now using the water highway of Rainy lake and Rainy river, and to the manufacturing towns along the river, both on the Canadian and United States sides.

It is claimed that the waters of Birch lake and Birch river and White Iron lake help to form the chain of lakes and rivers along the boundary which are referred to in the Webster-Ashburton treaty, and which, by the terms of the treaty, are a public highway, free to the citizens and subjects of both countries. The scheme of the Minnesota Canal and Power Company is to take 600 cubic feet per second out of a total estimated average flow of 985 cubic feet per second. The minimum flow is estimated at 210 cubic feet per second. The quantity to be taken, 600 cubic feet per second, would be more than the natural flow during the greater part of the year.

The corporation of the town of Fort Francis, on March 17, 1904, sent to the Minister of Marine and Fisheries of Canada, a protest against the proposed undertaking of the Minnesota Canal and Power Company. This protest has been sent by the Canadian government to the United States government, through the British Embassy at Washington.

On January 25, 1905, the Acting Secretary of State, F. B. Loomis, informed the Right Honourable Sir H. M. Durand, the British Ambassador in Washington (copy of his letter appended, marked 'W'), that the United States Secretary of the Interior had directed the Commissioner of the General Land Office, before whom the application of the Minnesota Canal and Power Company was pending, to suspend further action in the case until advised as to the results of the inquiry which was to be made by the International Water Boundary Commission.

Later on the Attorney General of the United States, called upon to give his opinion on the construction to be put upon the Act of Congress authorizing the appointment of the commission, stated in reference to the case of the St. John river, New Brunswick, that the jurisdiction of the commission was limited to the system of the Great Lakes and the St. Lawrence river. The members of the American section have since then felt reluctant in dealing with the question of the proposed works of the Minnesota Canal and Power Company, and they are awaiting further instructions from Congress in regard to this matter.

Since the Minnesota Canal and Power Company made this application to the United States Secretary of the Interior, the Rainy River Development Company and the Ontario and Minnesota Power Company have constructed extensive works at Koochiching falls for the purpose of improving navigation in Rainy lake and Rainy river, with the expectation of using the power which will be developed for manufacturing purposes. The Ontario and Minnesota Power Company, under a contract with the Ontario government, has acquired the Canadian end of the Koochiching falls, and a number of acres of shore land adjacent. They have obtained, during the last session of parliament, an Act of Incorporation, being chapter 139 and entitled, 'An Act respecting the Ontario and Minnesota Power Company.'

By an order in council, approved by the Governor General on September 19, 1905, the Minister of Public Works and the government of Canada have approved the plans of the Ontario and Minnesota Power Company (copy of the approval appended, marked 'X'). The engineers of the Department of Public Works stated that in so far as the construction of the dam at Koochiching falls is concerned, it will not in any way interfere with navigation above or below the falls at Fort Francis, but will, in fact, be an improvement. The dangerous rapids, two miles above Fort Francis, will be flooded, thereby improving materially the navigation. The freshet waters stored in Rainy lake could be let out during the season of low water, thereby also considerably improving navigation of the river between Fort Francis and the Lake of the Woods. The only objection that could be raised to the proposed elevation of the dam is provided for by a proposed revetment wall to be constructed by the company, and also by a clause in the Act of Incorporation of the company, which makes all damages to lands caused by their works a charge to be borne by them.

The proposed works of the Minnesota Canal and Power Company would interfere with the works authorized by His Excellency the Governor-in-Council. It is expected that soon after the present session of congress, the International Waterways Commission will take up this question.

On November 21, 1905, the chairman of the Canadian section, Mr. J. P. Mabee, having been appointed one of the justices of the High Court of Ontario, resigned, and Mr. George C. Gibbons, K.C., of London, Ont., was appointed in his place chairman of the Canadian section (copy of order in council appended, marked 'Y'). Since Mr. Gibbons' appointment there have been two meetings of the Canadian section, one in Toronto and one in Ottawa, at which the work of the commission has been fully reviewed and the various matters before the commission discussed.

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The Canadian section, in conclusion, desire to express their appreciation of the spirit of fairness shown by the members of the United States section in the discussion of all matters.

(Signed) GEO. C. GIBBONS,
Chairman of the Canadian Section.

(Signed) W. F. KING,
(Signed) LOUIS COSTE,
Members of Canadian Section.

(Signed) THOMAS COTÉ,
Secretary of Canadian Section.

Honourable C. S. HYMAN,
Minister of Public Works,
Ottawa, Ont.

APPENDIX 'A.'

Mr. Choate to the Marquis of Lansdowne.

American Embassy, London, July 15, 1902.

My Lord,—Under instructions from my government, I have the honour to inclose herewith four copies of a print of the Act of Congress, approved June 13, 1902, making appropriations for the improvement of rivers and harbours, and at the same time to draw your Lordship's attention to section 4, page 47, of the same, which provides for the appointment of an international commission, to be composed of three members from the United States and three who shall represent the Dominion of Canada, whose duty it shall be to investigate in general the waters adjacent to the boundary line between the United States and Canada, the effect upon the shores produced by changes in the water levels, and the erection and location of a dam at the outlet of Lake Erie. In bringing the matter to the attention of your Lordship, I am instructed to invite His Majesty's government to take part in the formation of the commission in question, and I should be much obliged if your Lordship would be so good as to cause me to be informed at the earliest moment which may be practicable, whether His Majesty's government would be disposed to accept the invitation of my government in this connection.

I have, etc.,

JOSEPH H. CHOATE.

APPENDIX 'B.'

From Colonial Office to Lord Minto.

London, December 2, 1902.

Section 4 of Act of Congress of United States of America, approved June 13 this year, for improvement of rivers and harbours, provides for appointment of international commission of six members, three from Canada, to investigate generally waters adjacent to international boundary. United States invite His Majesty's government to co-operate in formation of commission. What are views of your ministers? Telegraph reply. Papers were sent to Prime Minister July 30.

(Signed)

Secretary of State for the Colonies.

APPENDIX 'C.'

SECRETARY OF STATE FOR THE COLONIES TO THE EARL OF MINTO,

DOWNING STREET, December 3, 1902.

MY LORD,—I have the honour to transmit to your Excellency, to be laid before your ministers, the accompanying copy of a note from the American Ambassador at this court, respecting a proposed international commission to investigate the waters adjacent to the boundary line between the United States and Canada.

I shall be glad to receive any observations which your ministers have to offer at an early date.

A copy of this letter was communicated to Sir W. Laurier on July 30 last, but no answer has yet been received from him.

I have, etc.,

(Signed) ONSLAW,

For the Secretary of State.

APPENDIX 'D.'

EXTRACT from a report of the Committee of the Honourable the Privy Council, approved by the Governor General on April 27, 1903.

The Committee of the Privy Council have had under consideration a Colonial Office despatch, dated December 3, 1902, transmitting an abstract of section 4, of Act of Congress of the United States, approved June 13, 1902, which provides for the appointment of an international commission of six members, three representing the interests of Canada, and three from the United States, to investigate and report upon the conditions and uses of the waters adjacent to the boundary lines between the United States and Canada.

The Minister of the Interior, to whom the matter was referred, submits the following recommendations: That His Majesty's government accept the invitation to co-operate in the formation of the commission; and that, as the subjects to be dealt with pertain to the regulations of waters adjacent to the international boundary, thereby affecting harbours and navigation, all surveys and investigations necessary to carry out the intent of the commission be made, as far as Canada is concerned, under the Department of the Interior and the Department of Public Works; and also, that the appointment of the three members of the commission representing the interests of Canada be made on the recommendation of the Minister of the Interior and the Minister of Public Works.

The committee advise that the Governor General be moved to forward a copy of this minute to the Right Honourable the Secretary of State for the Colonies.

All of which is respectfully submitted for approval.

(Signed) JOHN J. McGEE,

Clerk of the Privy Council.

APPENDIX 'E.'

DOWNING STREET, June 6, 1903.

MY LORD,—I have the honour to acquaint your Excellency for the information of your ministers, that, in accordance with the terms of your despatch, No. 167, of May 4, the Secretary of State for Foreign Affairs has informed the United States chargé d'affaires that His Majesty's government accept the invitation of the United States government to co-operate in the formation of the commission to investigate the waters adjacent to the boundary line between the United States and Canada,

His Majesty's government accept the suggestion of your ministers as to the appointment of the commissioners, and I presume that steps will now be taken to carry their recommendations into effect and to select the three British representatives.

I have, &c.,

(Signed) J. CHAMBERLAIN.

APPENDIX 'F.'

EXTRACT from a report of the Committee of the Honourable the Privy Council, approved by His Excellency the Governor General, on December 3, 1903.

The Committee of the Privy Council have had under consideration a cablegram, dated October 16, 1903, from the Right Honourable the Secretary of State for the Colonies, transmitting the names of the three gentlemen appointed by the President of the United States as members of the proposed International Waterways Commission.

The Minister of the Interior, to whom the said despatch was referred recommends that Mr. William Frederick King, Chief Astronomer of the Department of the Interior, be appointed as one of the Canadian members of such commission.

The committee advise that the Governor General be moved to so inform the Right Honourable the Secretary of State for the Colonies.

All of which is respectfully submitted for approval.

(Signed) JOHN J. McGEE,
Clerk of the Privy Council.

APPENDIX 'G.'

EXTRACT from a report of the Committee of the Honourable the Privy Council, approved by His Excellency the Governor General, January 7, 1905.

The Committee of the Privy Council have had under consideration a despatch, herewith, from the Right Honourable the Secretary for the Colonies, numbered 306 and dated October 28, 1904, relating to the proposed International Commission to investigate and report upon the conditions and uses of the waters adjacent to the boundary line between the United States and Canada, and inviting the government of Canada to take the question of the appointment of the additional Canadian representatives into early consideration.

The Minister of the Interior, to whom the said despatch was referred, states that by an Act of Congress of the United States, passed in 1902, provision was made for the appointment of three persons to investigate the conditions and uses of the waters tributary to the River St. Lawrence, these persons to be one officer of the Corps of Engineers of the United States Army, one civil engineer well versed in the hydraulics of the Great Lakes, and one lawyer of experience in questions of international and riparian law.

The Minister also states that provision was further made for an invitation to the government of Great Britain to appoint an equal number of commissioners who should represent the interests of the Dominion of Canada.

The invitation having been extended, the formal assent of the government of Canada was given by minute of council, dated April 27, 1903, in which it was provided that the representatives of Canada should be named by the Minister of the Interior and the Minister of Public Works.

The Minister further states, that at a later date the President of the United States named his three Commissioners, and Mr. W. F. King, of the Department of the Interior was appointed by order in council on the recommendation of the Minister of the Interior.

The committee recommend that James P. Mabee, Esquire, K.C., of Toronto, and Louis Coste, Esquire, engineer, of Ottawa, be appointed commissioners in conjunction with Mr. King on the proposed International Commission.

The committee advise that the Governor General be moved to forward a copy of this minute to the Right Honourable the Secretary of State for the Colonies.

All of which is respectfully submitted for approval.

(Signed) JOHN J. McGEE,
Clerk of the Privy Council.

APPENDIX 'H.'

EXTRACT from a report of the Committee of the Honourable the Privy Council, approved by the Governor General on May 20, 1905.

The Committee of the Privy Council, on the recommendation of the President of the Privy Council, advise that James P. Mabee, Esquire, K.C., of Toronto be appointed chairman of the Canadian Commissioners to investigate the conditions and uses of the waters tributary to the River St. Lawrence, adjacent to the boundary lines between the United States and the Dominion.

(Signed) JOHN J. McGEE,
Clerk of the Privy Council.

APPENDIX 'I.'

OTTAWA, JANUARY 6, 1905.

SIR,—I have the honour to inform you that by a minute of the Privy Council, dated January 7, 1905, His Excellency the Governor General has been pleased to appoint Messrs. J. P. Mabee, K.C., of Toronto, and Louis Coste, C.E., of Ottawa, additional members of the International Commission to investigate and report upon the conditions and uses of the waters adjacent to the boundary line between the United States and Canada, to which you were appointed on December 3, 1903.

I inclose a copy of the minute of council appointing these gentlemen, and also an extract from the American statutes authorizing the appointment of the United States members of the commission

Among the subjects that may come up for consideration before this commission are:

1. The proposed diversion southward by the Minnesota Canal and Power Company of Duluth, of certain waters in the State of Minnesota, that now flow north into the Rainy river and the Lake of the Woods.

2. The diversion about a mile and a half east of the town of Sault Ste Marie of part of the waters of the St. Marys river into the Hay canal entirely through American territory. The river St. Marys now form part of the boundary between the United States and Canada, and the waters of the river are clearly international. The Canadian vessels of necessity are using the Hay canal, but no treaty has been made concerning their right.

3. Enquiry into the effect of the levels of Lakes Huron and Erie by the construction of the Chicago canal.

4. The building of a dam and other obstructions on the St. John river, flowing through the State of Maine into New Brunswick, contrary to the express stipulation of the Ashburton treaty.

The government are of the opinion that the Canadian members of the commission should come together at an early date, and I have so informed Messrs. Mabee and Coste, and asked them to confer with you as to the date of meeting.

It is proposed to appoint Mr. Thomas Côté, journalist, of Montreal, as secretary to the Canadian section of the commission.

I have the honour to be, sir,

Your obedient servant,

(Signed) R. W. SCOTT,

Secretary of State.

W. F. KING, Esq.,
Chief Astronomer,
Department of the Interior, Ottawa.

SESSIONAL PAPER No. 19a

APPENDIX 'J.'

DEPARTMENT OF STATE,
WASHINGTON, D.C. April 15, 1905.

SIR,—Referring to your letter of the 10th ultimo, asking as to the instructions which may be required by the American Commissioners appointed under section 4 of the River and Harbour Act of 1902 (32 Sta. L., 373), especially in regard to a question which you state is likely to arise concerning the scope of the commission's investigation, the Canadian members appearing to be disposed to regard it as taking in all waters adjacent to the boundary line, whether part of the Great lakes or not, I have to state as follows:—

The wording of the law will be seen by reference to the inclosed copy. The Department's opinion is that the words 'including all of the waters of the lakes and rivers whose natural outlet is by the River St. Lawrence to the Atlantic Ocean,' are intended as a limitation on what precedes them, and that the investigation and report should cover only such waters, omitting the lower St. Lawrence itself as well as all other waters not discharging naturally through it.

The broader interpretation given to the Act by the Canadian authorities should be rejected, if for no other reason on account of the smallness of the appropriation for the support of the American section. Congress could hardly have intended to provide with a sum of $20,000 for the expenses incident to an investigation extending to the Pacific coast, and possibly embracing the Alaskan boundary as well.

A portion of the report of the chairman of the Rivers and Harbours Committee, when reporting the bill (copy of Act herewith), treats of section 4, and would appear to limit the scope of the investigation to the Great Lakes system.

When the ground to be covered has been defined, the law itself appears to be sufficiently detailed to serve as instructions to the American Commissioners.

It seems sufficient, therefore, at the present stage to inform you and the other members of the American section of the views held by the Department as to the scope of the investigation and report, and to request the American Commissioners to assemble and organize as soon as possible after the 20th instant, at this capital, and to submit, after discussion, their own recommendations as to further procedure.

I inclose, also, for your information, copies of letters from Colonel Ernst and Professor Williams in regard to the place of meeting of the commission.

Copies of your letter of the 10th ultimo, and of this, the Department's reply, have been addressed to Colonel Ernst and Professor Williams for their guidance.

I am, sir, your obedient servant,

(Signed) F. B. LOOMIS,
Acting Secretary.

GEO. CLINTON, Esq.,
Commissioner of the United States,
International Waterways Commission,
1012 Prudential Building, Buffalo, N.Y.

APPENDIX 'K.'

To His Excellency the Governor General:

The undersigned has the honour to represent that on May 4, last, he submitted to Your Excellency's predecessor a minute of the Executive Council of New Brunswick, calling attention to the erection by the St. John Lumber Company, a United States corporation—of certain piers and booms in the St. John river, near the village of Van Buren, in the State of Maine, and advised that the attention of the government of the United States be drawn to the subject, with a view to the removal of the obstruction complained of, the erection of which it was pointed out constitutes a violation of Article III. of what is commonly known as the Ashburton Treaty of 1842; providing that the navigation of the St. John river shall be free and open to both parties and shall in no way be obstructed by either. No answer appears to have been received to this communication.

The undersigned has now the honour to submit to Your Excellency a petition signed by Mr. J. Fraser Gregory, on behalf of certain lumbermen and mill-owners of St. John in convention, pointing out that not only has no action been taken on the petition of the provincial government of New Brunswick, but a bill is actually before the legislature of the State of Maine having for its object the incorporation of another company with powers to construct further piers in the said river almost immediately below those built by the St. John Lumber Company, which formed the subject of the previous remonstrance. Messrs. Gregory and his associates point out that if the proposed fresh obstructions are allowed to be erected, great damage will ensue to Canadian lumbermen and mill-owners along the St. John river. The undersigned, concurring in this view, recommends that a copy of this memorial be transmitted to His Majesty's Ambassador at Washington, and that Sir Mortimer Durand be again requested to bring the subject to the early attention of the United States authorities with a view not merely to the removal of the obstruction immediately complained of, but also to the postponement of any action on the part of the Maine legislature with respect to legislation in the direction indicated above, until the International Commission which has recently been appointed to consider the whole question, shall have made its report.

All of which is respectfully submitted.

(Signed) R. W. SCOTT,
Secretary of State.

Ottawa, February 1, 1905.

From Lord Grey to Sir Mortimer Durand.

Ottawa, February 3, 1905.

Sir,—With reference to my predecessor's despatch, No. 38, of May 5, 1904, requesting that representations might be made to the United States government in regard to the erection of certain piers and booms in the St. John river, which was considered by this government to involve a violation of article III. of the Ashburton Treaty of 1842, I have the honour to inclose a copy of a further report from the Secretary of State of Canada, submitting a petition from certain lumbermen and millowners of St. John, New Brunswick, in which it is pointed out that so far from action having been taken to remove the obstruction to the navigation of the river of which complaint was made, a bill is now before the Maine legislature to incorporate a company with power to construct other piers which will cause further damage to Canadian interests.

Your Excellency will observe that the minister suggests that the matter again be brought to the attention of the United States authorities, with the view of obtaining the removal of the obstructions complained of, and the postponement of action on the bill referred to, until the International Waterways Commission, recently appointed, shall have made its report.

I have, &c.,

(Signed) GREY.

His Excellency the Right Honourable
Sir Mortimer Durand, G.C.M.G., Etc., Etc.,Etc.

APPENDIX 'L.'

Sir H. M. Durand to Lord Grey.

British Embassy, Washington, February 27, 1905.

My Lord,—On receipt of your Excellency's despatch, 3rd instant, relative to the erection of further piers in the St. John river, I at once addressed a note to the United States government bringing the matter to their notice, and suggested that action be deferred on the bill pending before the Maine legislature, and that obstructions already erected should be removed.

I have now the honour to transmit copy of the letter which I have received from the United States Secretary of State in reply.

I have, etc.,

(Signed) H. M. DURAND.

APPENDIX 'M.'

Department of State,
Washington, D.C., February 24, 1905.

Excellency,—I have conferred with my colleagues of the Departments of War and Justice touching the suggestion made in your note of February 11, at the instance of the Canadian government, that it would appear desirable that until the recently appointed commission on international waterways has submitted its report, action should be postponed upon a bill now before the Maine legislature providing for the incorporation of a company with power to construct piers in the St. John river, additional to those complained of in your prior note of May 9, 1904, and that, meanwhile, the obstructions already erected should be removed.

It is the view of my colleagues that, under the 4th section of the Rivers and Harbours Act of June 13, 1902, the function of the International Waterways Commission, the creation of which was authorized and invited by that Act, do not extend beyond the execution of the purposes therein defined, namely, the investigation of the problems of water level, water supply and navigation in the Great Lakes and tributary streams having their natural outlet by the River St. Lawrence to the Atlantic ocean. The St. John river does not belong to the water system intended to be investigated, and consequently the future report of the International Waterways Commission would have no relation to the complaint now presented. It would remain a separate matter for consideration.

The attention of the Attorney General has again been called to the matter of the existing obstructions in the St. John river.

I have, etc.,

(Signed) JOHN HAY.

APPENDIX 'N.'

EXTRACT from a report of the Committee of the Honourable the Privy Council, approved by the Governor General, on March 25, 1905.

The Committee of the Privy Council have had under consideration a despatch dated February 27, 1905, from His Majesty's Ambassador at Washington, concerning the scope of the International Waterways Commission.

The Minister of Public Works, to whom the question was referred, observes that the United States Secretary of State draws attention to the fact that the Act of Congress authorizing the creation of the commission, does not extend beyond the execution of the purposes therein defined, viz.: 'The investigation of the problems of water level, water supply and navigation on the Great Lakes and tributary streams having their natural outlet by the River St. Lawrence to the Atlantic ocean.'

The minister further observes that the Secretary of State states that as the St. John river does not belong to the water system intended to be investigated, the future report of the International Waterways Commission can have no relation to a complaint made concerning work executed and to be executed on the St. John river, which would, therefore, remain a separate matter for consideration.

The Minister, in view of the above statement, which would go far to restrict the range and scope of the International Waterways Commission, has procured a copy of the Act of Congress above referred to, and submits a verbatim copy of section 4 of chapter 1079 of the statutes of the United States, passed by the 57th Congress, the section in question being as follows, that is to say:—

'That the President of the United States is hereby requested to invite the government of Great Britain to join in the formation of an International Commission, to be composed of three members from the United States and three who shall represent the interests of the Dominion of Canada, whose duty it shall be to investigate and report upon the conditions and uses of the waters adjacent to the boundary line between Canada and the United States, including all of the waters of lakes and rivers whose natural outlet is by the River St. Lawrence to the Atlantic ocean, also upon the maintenance and regulation of suitable levels; and also upon the effect upon the shores of these waters and the structures thereon, and upon the interests of navigation by reason of the diversion of these waters from or change in their natural flow, and further to report upon the necessary measures regarding such diversion, and to make such recommendation for improvements and regulations as shall best subserve the interests of navigation in said waters.

'And said commissioners shall report upon the advisability of locating a dam at the outlet of Lake Erie with a view to determining whether such dam will benefit navigation, and if such structure is deemed advisable, shall make recommendations to their respective governments looking to an agreement or treaty which shall provide for the construction of the same; and they shall make an estimate of the probable cost thereof.'

The Minister further observes that throughout the correspondence which has taken place, prior to the appointment of the Canadian section of the commission, the terms used have always been identical to those of the Act above referred to, and that it has always been understood that the investigation would bear upon the conditions and uses of the waters adjacent to the boundary line between Canada and the United States, the other waters belonging to the lakes and rivers whose natural outlet is by the River St. Lawrence to the Atlantic ocean, being stated to be also included therein, but the general scope of the commission being especially intended to apply to all waters adjacent to the boundary line between Canada and the United States.

The Minister, therefore, is of the opinion that in the despatch under his consideration an unintentional misapprehension has existed as regards the terms of the Act of Congress, and that it is fit and proper that the work of the commission be not restricted to narrower limits than those indicated by the said Act.

The Minister, therefore, recommends that the necessary representations be made in order that the investigation to be carried on by the said commission, and the report to be based thereon, shall extend to all the waters adjacent to the boundary line between Canada and the United States, and, therefore, include such portions of the St. John river as will come within the limit assigned by the Act of Congress to the work of the commission.

The committee advise that His Excellency be moved to forward a copy of this minute to His Majesty's Ambassador at Washington.

All of which is respectfully submitted for approval.

(Signed) JOHN J. McGEE,
Clerk of the Privy Council.

APPENDIX 'O.'

DEPARTMENT OF STATE,
WASHINGTON, D.C., May 31, 1905.

EXCELLENCY,—I have the honour to acknowledge the receipt of Mr. O'Beirne's note of the 22nd instant, by which he informs me that he is instructed by Lord Lansdowne to express the hope that the United States government will see its way, without necessarily conceding the principle of its contention as to the scope of the Waterways Commission, to agree to the wish of the Canadian government that the commission should deal with the question of the obstruction of the St. John river.

Serious consideration has been given to Mr. O'Beirne's note, and I regret to reply that this government is unable to accede to the Canadian government's wish. As your ambassy has been advised in a former note, this government's construction of the Act of Congress is that the Waterways Commission created thereunder has no jurisdiction over the St. John river; and in the opinion of this government such jurisdiction can be exercised only by authority of Congress. Moreover, as the questions which have arisen regarding the St. John river affect particularly the State of Maine and the province of New Brunswick, such questions should be considered only by a commission on which both of them shall be represented.

I think I can assure Your Excellency that Congress will, in the early part of its next session, provide for a commission, to be joined with one from Canada, to examine fully into the questions in controversy between the business interests of Maine and those of New Brunswick with regard to the St. John river, and this government sees no reason why the whole matter may not be satisfactorily adjusted by such a commission within a short period of time.

I have the honour to be, &c.,

(Signed) F. B. LOOMIS,
Acting Secretary.

The Right Honourable Sir H. M. DURAND, &c.

APPENDIX 'P.'

INTERNATIONAL WATERWAYS COMMISSION.

(Canadian Section.)

SECRETARY'S OFFICE,
OTTAWA, June 2, 1905.

Hon. W. S. FIELDING,
Minister of Finance,
Acting Minister of Public Works, Ottawa, Ont.

DEAR SIR,—By direction of the Canadian section of the International Waterways Commission, I have the honour to report as follows:—

On May 11 last, the American Commissioners met in Washington, and decided to invite the Canadian section to a joint meeting, to be held in Washington on the 25th of the same month.

The commission actually met at the office of Colonel O. H. Ernst on May 25, at 10.30 a.m. There were present: Mr. J. P. Mabee, chairman of the Canadian section; Messrs. W. F. King and Louis Coste, members of the Canadian section, and Mr. Thomas Côté, secretary of the Canadian section; Colonel O. H. Ernst, chairman of the American section; Professor Gardner S. Williams and Mr. George Clinton, members of the American section.

The commission proceeded in a body to call upon the Secretary of State, and after a brief interview with Mr. F. B. Loomis, first assistant and acting secretary, returned to the first place of meeting, and devoted several hours to an informal discussion of the organization, permanent place of meeting, and scope of duties of the commission, but came to no conclusion thereon, and at 1.45 p.m., adjourned to meet the next day at 11 o'clock a.m.

On May 26, the commission met again to the office of Colonel Ernst, at 11 o'clock a.m. There were present all the members of the joint commission and the secretary of the Canadian section. An organization was effected by the election of Colonel Ernst as chairman of this meeting, it being agreed that at meetings of the full commission held on American territory the chairman of the American section should preside, and at meetings held on Canadian territory, the chairman of the Canadian section should preside.

It was decided that for the present the offices of the Canadian section should be established in Toronto, and those of the American section in Buffalo, and that full meetings should be held in one or the other city from time to time, as should be found most convenient.

The American section presented the instructions under which they are acting, as embodied in the following letter, viz:—

'DEPARTMENT OF STATE,
'Washington, D.C., April 15, 1905.

'GEORGE CLINTON, Esq.,
'Commissioner of the United States,
'International Waterways Commission,
'1012 Prudential Building, Buffalo, N.Y.

'SIR,—Referring to your letter of the 10th ultimo, asking as to the instructions which may be required by the American commissioners appointed under section 4 of the Rivers and Harbours Act of 1902 (Statutes-at-large, volume 32, page 375), especially in regard to a question which you state is likely to arise concerning the scope of the commission's investigation, the Canadian members

appearing to be disposed to regard it as taking in all waters adjacent to the boundary line, whether part of the Great Lakes or not, I have to state as follows:—

'The wording of the law will be seen by reference to the inclosed copy. The department's opinion is that the words, "including all the waters of the lakes and rivers whose natural outlet is by the River St. Lawrence to the Atlantic ocean," are intended as a limitation of what precedes them, and that the investigation and report should cover only such waters, omitting the lower St. Lawrence itself, as well as all other waters not discharging naturally through it.

'The broader intrepretation given to the Act by the Canadian authorities should be rejected, if for no other reason, on account of the smallness of the appropriation for the support of the American section. Congress could hardly have intended to provide, with a sum of $20,000, for the expenses incident to an investigation extending to the Pacific coast, and possibly embracing the Alaskan boundary as well.

'A portion of the report of the chairman of the Rivers and Harbours Committee, when reporting the bill (copy of Act herewith) treats of section 4, and would appear to limit the scope of the investigation to the Great Lakes system.

'When the ground to be covered has been defined, the law itself appears to be sufficiently detailed to serve as instructions to the American commissioners.

'It seems sufficient, therefore, at the present stage, to inform you and the other members of the American section of the views held by the department as to the scope of the investigation and report; and to request the American commissioners to assemble and organize, as soon as possible after the 20th instant, at this capital, and to submit, after discussion, their own recommendations as to further procedure.

'I inclose also, for your information, copies of letters from Colonel Ernst and Professor Williams, in regard to the place of meeting of the Commission.

'Copies of your letter of the 10th ultimo and of this, the department's reply, have been addressed to Colonel Ernst and Professor Williams for their guidance.

I am, sir, your obedient servant,

'(Signed) F. B. LOOMIS,

'Acting Secretary'.

The Canadian section then communicated to the American Commissioners the views of the Canadian government, which are embodied in the following extract from a report of the Committee of the Honourable the Privy Council, approved by the Governor General on March 25, 1905:—

'The Committee of the Privy Council have had under consideration a despatch, dated Frebuary 27, 1905, &c., &c.'

(See order in council, referred to under heading of appendix 'N,' page 28, of this report.)

The Canadian section then presented the following memorandum:—

'The Canadian members of the International Waterways Commission had understood the scope of the commission to be wider, &c., &c.'

(This memorandum will be found at page 6 of this report.)

(Signed) J. P. MABEE,

Chairman Canadian Section.

WASHINGTON, D.C., May 26, 1905.

The chairman of the American section stated that he was informed that the British government had communicated with the American government through diplomatic channels, requesting that the broader interpretation above described be given to the law of Congress, providing for the commission, that the American government had the matter under consideration, and that a decision could not be expected before the return of Secretary Taft to Washington on Monday the 29th, or Tuesday the 30th ultimo.

It was decided that further action be deferred until the decision be given, and until further instructions be received from the two governments. It was further decided that the decision of the American government should be communicated to the chairman of the Canadian section as soon as received, and that if it be favourable to the Canadian interpretation of the law, or if it be unfavourable and be accepted by the Canadian government, then a meeting of the commission should be called at Ottawa by the chairman of the American section at as early a date as may be convenient to the members.

At 12.30 p.m. the commission took recess until 4 p.m.

The commission reconvened at 4 p.m., and having heard the minutes of preceding meetings read, approved them, and then adjourned *sine die*.

On Monday, May 29, I called at the British Embassy and handed to His Excellency the Right Honourable Sir H. Mortimer Durand, copy of the minutes of the proceedings of the preliminary meetings of the commission. He informed me that he would call on Wednesday, May 31, on Secretary of War Taft and on Acting Secretary of State Loomis, to press again the Canadian interpretation of the Act of Congress, passed in 1902, and authorizing the formation of the commission.

I have received to-day from Mr. O'Beirne, Secretary of the British Embassy and the chargé d'affaires in Washington, during the absence of Sir H. Mortimer Durand, the following telegram: 'This government regret they cannot agree with your commission dealing with St. John river. Have wired fully Governor General. (Signed) O'Beirne.'

The Canadian section is now awaiting further instructions from His Excellency the Governor General in council.

All of which is respectfully submitted.

(Signed) THOMAS CÔTÉ,
Secretary Canadian Section.

APPENDIX 'Q.'

INTERNATIONAL WATERWAYS COMMISSION,

(American Section)

OFFICE OF CHAIRMAN, ROOM 328, MILLS BUILDING,
WASHINGTON, D.C., June 2, 1905.

DEAR SIR,—I have the honour to inform you that our government has found itself unable, after very serious consideration of the question, and after having submitted it to the Attorney General, to accede to the desire of the Canadian government to include the St. John river within the scope of the commissioners' work, and that I am authorized to communicate this decision to you informally. It has been communicated formally to the British government through diplomatic channels.

I am further authorized to assure you that it is the firm expectation of our government that our Congress will, in the early part of its next session, provide for a commission to work jointly with one from Canada to examine fully into

the questions in controversy between the business interests of Maine and New Brunswick, with regard to the St. John river.

Allow me to express the hope that this decision will not prevent the prosecution of the work of the commission within the field prescribed to the American section, as communicated to you at our session held here on the 25th and 26th ultimo, and that I shall have many opportunities for renewing the agreeable acquaintance so auspiciously begun on that occasion.

Yours very respectfully,

(Signed) O. H. ERNST,
Colonel, Corps of Engineers, Chairman American Section.

J. P. Mabee, Esq.,
Chairman Canadian Section,
International Waterways Commission,
Bank of Toronto Building, Toronto, Canada.

APPENDIX 'R.'

International Waterways Commission,
(Canadian Section)
Office of Chairman, Bank of Toronto Building,
Toronto, June 7, 1905.

My Dear Sir,—I have the honour of acknowledging yours of June 2, advising me that the government of the United States, after very serious consideration, has found itself unable to accede to the desire of the Canadian government to include the St. John river within the scope of the commission's work, but at the same time assuring me that it is the firm expectation of your government that Congress will, in the early part of its next session, provide for a commission, to work jointly with one from Canada, to examine fully into the questions in controversy between the business interests of Maine and New Brunswick with regard to the St. John river.

The final position taken by your government has been laid before the government of Canada, and I have the honour of informing you that with full reliance of your assurance relating to the unfortunate differences regarding the uses of the waters of the St. John river, our government has authorized the Canadian Commissioners to proceed with the inquiry within the field prescribed by the interpretation placed upon the Act of Congress by your Attorney General, and at the same time, I am specially charged by the Premier of Canada to draw the attention of your section of the commission to the condition of matters along the St. John river, and to the necessity of prompt joint action thereon.

A meeting of our section has been called for to-morrow, and I shall advise you at once of the date suggested for a joint meeting, pursuant to our arrangement at Washington.

Personally, I am gratified at the conclusion arrived at by our government, and I am sure that my brother Commissioners of the Canadian section will look forward with great pleasure to the future joint meetings of the commission.

Believe me, my dear sir, yours very respectfully,

(Signed) J. P. MABEE,
Chairman of Canadian Section International Waterways Commission.

Colonel O. H. Ernst,
Chairman American Section,
International Waterways Commission,
Mills Building, Washington, United States of America.

APPENDIX 'S.'

Proceedings of the session held by the International Waterways Commission in Ottawa on Friday, July 7th, and relation of public functions connected with it.

The Commissioners met at 12 noon, at the Russell House.

Present:—Colonel O. H. Ernst, Chairman of the American section; Messrs. George Clinton and G. Y. Wisner, Members of the American section. Mr. James P. Mabee, Chairman of the Canadian section; Messrs. W. F. King and Louis Coste, Members of the Canadian section, and Mr. Thomas Coté, Secretary of the Canadian section.

The Commissioners first proceeded in a body to call upon the Right Honourable Sir Wilfrid Laurier, G.C.M.G. After a brief interview with the Prime Minister of Canada, the Commission went to the Chambers of the Honourable the Speaker of the Senate to pay their respects to Honourable Raoul Dandurand.

The Commissioners also proceeded in a body to call upon the Honourable the Minister of Marine and Fisheries and pay their respects to Honourable Raymond Préfontaine.

The Commissioners called also at the office of the Honourable the Minister of Public Works and left their cards in the hands of Honourable C. S. Hyman's, private secretary, as a mark of respect for the Minister who had been unavoidably called out of town to attend the funeral of the late Doctor T. G. Johnston, M.P. for West Lambton, Ontario.

At 1 o'clock p.m., at the invitation of Honourable R. F. Sutherland, Speaker of the House of Commons, the Commissioners were received at lunch in the official Chambers of the Speaker, in the Parliament Buildings.

At 2.30 p.m. the Commission met at the offices of the Canadian section. Mr. James P. Mabee, Chairman of the Canadian section presided.

The Secretary informed the Commissioners that, in compliance with a decision arrived at at their meeting in Toronto, on the 15th of June, 1905, he had invited the public bodies of Montreal to attend a public meeting called for the 11th of July and to be held in Montreal.

The letter of invitation reads as follows:—

INTERNATIONAL WATERWAYS COMMISSION.

(Canadian Section.)

Ottawa, 16th June, 1905.

Dear sir,—In June, 1902, the Congress of United States passed a law, authorizing the appointment of an International Commission to deal with certain questions relating to the waters adjacent to the boundary lines between Canada and the United States.

The section of the Act which refers to such a Commission, reads as follows:

'Section 4.—That the President of the United States is hereby requested 'to invite the Government of Great Britain to join in the formation of an inter-'national commission, to be composed of three members from the United States 'and three who shall represent the interests of the Dominion of Canada, whose 'duty it shall be to investigate and report upon the conditions and uses of the 'waters adjacent to the boundary lines between the United States and Canada,

'including all of the waters of the lakes and rivers whose natural outlet is by the 'River St. Lawrence to the Atlantic Ocean; also upon the maintenance and 'regulation of suitable levels; and also upon the effect upon the shores of these 'waters and the structures thereon, and upon the interests of navigation, by 'reason of the diversion of these waters from or change in their natural flow; 'and, further, to report upon the necessary measures to regulate such diversion, 'and to make such recommendations for improvements and regulations as shall 'best subserve the interests of navigation in said waters. The said Commis- 'sioners shall report upon the advisability of loeating a dam at the oulet of 'Lake Erie, with a view to determinating whether such dam will benefit naviga- 'tion, and if such structure is deemed advisable, shall make recommendations 'to their respective Governments looking to an agreement or treaty which shall 'provide for the construction of the same, and they shall make an estimate of 'the probable cost thereof. The President in selecting the three members of 'said commission who shall represent the United States, is authorized to appoint 'one officer of the Corps of Engineers of the United States Army, one civil 'engineer well versed in the hydraulics of the Great Lakes, and one lawyer of 'experience in questions of international and riparian law, and said Commission 'shall be authorized to employ such persons as it may deem needful in the 'performance of the duties hereby imposed; and for the purpose of paying 'the expenses and salaries of the said Commission the Secretary of War is au- 'thorized to expend from the amounts heretofore appropriated for the St. Marys 'River at the Falls, the sum of twenty thousand dollars, or so much thereof 'as may be necessary to pay that portion of the expenses of said Commission 'chargeable to the United States.'

In compliance with this clause of Congress, the United States Government have appointed as their representatives: Colonel O. H. Ernst from the Corps of Engineers of the United States Army, of Washington, D.C.; Mr. George Clinton, Attorney at law of Buffalo, N.Y., and Professor George Y. Wisner from Detroit, Mich., and His Excellency the Governor General in Council has appointed as Commissioners for Canada: Mr. James P. Mabee, K.C. of Toronto; W. F. King, Chief Dominion Astronomer; Mr. Louis Coste, civil engineer of Port Colborne, and the undersigned as Secretary of the Canadian Section.

The Commission, as above constituted, has held a meeting yesterday in Toronto, at which the question of locating a dam at the outlet of Lake Erie has been considered.

As the building of such works may or may not affect the lower St. Lawrence, the Harbour of Montreal and the Ship Channel between Montreal and Quebec, the Commission has decided to invite the Montreal Harbour Commissioners, the Montreal Board of Trade, the Municipal Authorities, of the same city, and the Chamber of Commerce of the district of Montreal, and the various shipping interests, to present their views on the matter at a public meeting which will be held in Montreal on Tuesday, the 11th of July next, at eleven o'clock A.M.

I am instructed by the Commission to inform you of its decision, and to invite you and the members of your Board to be present at the meeting, to offer your views on this important question.

Would you please let me know at your earliest convenience, if the date selected by the International Waterways Commission, for its meeting, suits the convenience of the members of the Harbour Board.

Yours very truly,

THOMAS COTÉ,

Secretary International Waterways Commission.

This letter was adressed to the following gentlemen:—

Honourable Robert MacKay, Member of the Canadian Senate and President of the Harbour Commissioners of Montreal; His Worship Mayor H. Laporte of Montreal; Mr. H. A. A. Brault, President of the Chamber of Commerce of the District of Montreal; Hugh A. Allan, President of the Shipping Federation of Canada; Honourable R. Préfontaine, Minister of Marine and Fisheries; Mr. A. Gobeil, Deputy Minister of Public Works; Chas. J. Smith, General Manager of the Richelieu and Ontario Navigation Company, and Member of the Dominion Marine Association.

The Secretary informed the Commission that the invitation had been accepted by all the gentlemen above mentioned.

A communication from Mr. George Hadrill, Secretary of the Montreal Board of Trade, offering to put at the disposal of the Commission the rooms of their Council for the purpose of holding the meeting of the 11th of July, was read. The Secretary was instructed to extend the Commission's thanks to the Montreal Board of Trade for their kind offer.

The Secretary presented a list of the Companies forming the Shipping Federation of Canada, with their respective representatives and the gross tonnage of their ships for 1905. The statement, as furnished by Mr. Thomas Robb, Manager and Secretary of the Shipping Federation of Canada, reads as follows:—

THE SHIPPING FEDERATION OF CANADA.

List of members and tonnages entered with The Shipping Federation of Canada, 1905.

Line.	*Gross Tonnage.*	*Representative.*
Allan	86,208	Hugh A. Allan.
Dominion	54,765	John Torrance.
Leyland	26,100	James Thom.
Donaldson	33,928	R. W. Reford.
Thomson	28,649	"
Lord	5,951	"
Scotia	30,496	"
Manchester	24,016	J. R. Binning.
Furness, Withy & Co. (South African Line).	8,623	"
Head Line	35,759	Chs. McLean.
Elder Dempster & Co	16,021	D. W. Campbell.
Dominion Coal Co	10,000	F. L. Wanklyn.
Routh & Co., (Nova Scotia Steel Co.)	4,291	F. A. Routh & Co.
J. G. Brock & Co., (Quebec S.S. Co.)	1,697	J. G. Brock.
Canadian Ocean and Inland Line	4,298	Thomas Harling
Hambourg-American	3,066	James Thom.
	373,868	
Affiliated tonnage	166,219	
Total	540,087	gross tons.

NOTE:—The affiliated tonnage includes tramp and other outside vessels who are represented by the agent to whom they are consigned.

The Secretary also presented a list of the Companies forming the Dominion Marine Association, as furnished him by Mr. Francis King, Secretary-Treasurer of the Association, which reads as follows:—

SESSIONAL PAPER No. 19a

THE DOMINION MARINE ASSOCIATION.

The Calvin Co., Limited, Garden Island, Ont.
James H. Hall, R. T. Holcomb, The Ottawa Forwarding Co., Ottawa.
W. E. Lawlor, Hawkesbury, Ont.
The Trent Valley Navigation Co., Ltd., Bobcaygeon, Ont.
The Midland Navigation Co., Ltd., Midland, Ont.
J. & T. Conlon, Thorold, Ont.
Niagara Navigation Co., Limited, Toronto, Ont.
The Rideau Lakes Nav. Co., Ltd., Kingston, Ont.
A. A. Wright (Steamer Tadousac), Toronto, Ont.
The Victoria Harbour Lumber Co., Victoria Harbour, Ont.
The Upper Ottawa Improvement Co., Limited, Ottawa.
The Western Steamship Co., Ltd., Toronto.
The Ontario & Quebec Nav. Co., Ltd., Picton, Ont.
The Rat Portage Lumber Co., Ltd., Rat Portage, Ont.
The Nelson River Packing Co., Selkirk, Man.
The Northwest Navigation Co., Ltd., Selkirk, Man.
The Huntsville, Lake of Bays & Lake Simcoe Nav. Co., Ltd., Huntsville, Ont.
The Pembroke Navigation Co., Pembroke, Ont.
The St. Lawrence and Chicago Steam Nav. Co., Ltd., Toronto.
The Rathbun Co., (The Desoronto Nav. Co. Ltd.,) Desoronto, Ont.
The Montreal Transportation Co., Ltd., Montreal.
The Muskoka Lakes Navigation & Hotel Co., Ltd., Gravenhurst, Ont.
The Canadian Pacific Car & Passenger Transfer Co., Ltd., Prescott, Ont.
The Ogdensburg Towing Co., Ltd., Montreal.
The Northern Navigation Co., Limited, Collingwood, Ont.
The Rainy River Nav. Co., Ltd., Rat Portage, Ont.
The St. Lawrence River Steamboat Co. Ltd., Kingston, Ont.
The Ottawa Transportation Co., Limited, Ottawa.
The British Yukon Nav. Co., Ltd., (White Pass and Yukon Route) White Horse, Y.T.
J. B. Fairgrieve, Hamilton, Ont.
The New Ontario Steamship Co., Ltd., Hamilton, Ont.
The Hamilton and Fort William Nav. Co., Ltd., Hamilton, Ont.
The Hamilton Steamboat Co., Hamilton, Ont.
The Toronto and Montreal Steamboat Co., Toronto.
C. A. Jacques (The Melbourne, City of Montreal & Cuba), Montreal.
J. B. Miller, Toronto.
T. Marks & Co., The Canadian Northwest Steamship Co., Ltd., Port Arthur and Toronto.
The Ottawa River Navigation Co., Ltd., Montreal.
James Richardson & Sons, Kingston, Ont.
The Ewing & Fryer Fish Co., Selkirk, Man.
The Niagara, St. Catharines & Toronto Nav. Co., Ltd., St. Catharines, Ont.
F. E. Hall, L'Orignal, Ont.
A. Hicks, Trenton, Ont.
Dominion Fish Co., Limited, Selkirk, Man.
The Northern Fish Co., Selkirk, Man.
The Myles Transportation Co., Ltd., Niagara Falls, N.Y.
The Lake Ontario and Bay of Quinté Nav. Co., Ltd., Kingston, Ont.
The Canadian Lake & Ocean Nav. Co., Ltd., Toronto, Ont.
The International Ferry Co., Buffalo, N.Y.
A. E. Pontbriand, Sorel, P.Q,
R. Cunningham & Sons, Port Essington, B.C.
Richelieu & Ontario Nav. Co., Ltd., Montreal.
Donnelly Salvage & Wrecking Co., Ltd., Kingston, Ont.

The Secretary stated that the Honourable the Minister of Marine and Fisheries had put at the disposal of the Commission the Ship Channel Steamer 'Frontenac' for their inspection trip of the St. Lawrence Ship Channel from Quebec to Montreal and of the Canal System as far up as to Kingston, as shown by the following letter:—

OFFICE OF THE MINISTER OF MARINE AND
FISHERIES OF CANADA,

OTTAWA, 20th June, 1905.

THOMAS CÔTÉ, Esq.,
Secretary, International Waterways Commission,
Ottawa.

DEAR SIR,—I have yours of the 19th instant, and have given instructions to my officers to place Steamer 'Frontenac' at the disposal of your Commission on the 9th July next, if no other arrangements have already been made for that date.

My Deputy Minister will communicate further with you in reference to this matter.

Yours truly,
R. PRÉFONTAINE.

The Secretary informed the Commissioners that the Honourable R. Préfontaine, Minister of Marine and Fisheries of Canada, and the Harbour Commissioners of Montreal, had decided to invite a certain number of public men, as well as the representatives of the shipping interests and the commercial communities of Montreal to make with the Commission an inspection of the works of improvement now being carried out at the National Port of Canada, and that the new Steamer 'Montreal' of the Richelieu and Ontario Navigation Company had been hired by both the Minister of Marine and Fisheries and the Harbour Commissioners of Montreal for that trip.

It was then moved by Colonel O. H. Ernst, seconded by Mr. W. F. King and resolved: that the Secretary be instructed to extend the thanks of the Commissioners to the Honourable the Minister of Marine and Fisheries and to the Harbour Commissioners of Montreal for their great kindness in giving them the opportunity of making a thorough inspection of the National Port of Canada.

The Secretary informed the Commission that in compliance with instructions received at the meeting held in Toronto on the 15th June last, he had communicated with Colonel F. Gourdeau, Deputy Minister of Marine and Fisheries, in reference to signal lights between Windsor and Detroit, and he gave communication of the following answer he had received:—

DEPARTMENT OF MARINE AND FISHERIES,
DEPUTY MINISTER'S OFFICE,
OTTAWA, CANADA, 20th June, 1905.

DEAR SIR,—In reply to your letter of the 17th instant, I have to advise you that the 'Rule of the Road' for the Inland Waters of Canada was amended last year, to conform with the United States practice, and, therefore, the difference that Mr. Hays alludes to no longer exists.

I enclose for your information two copies of the printed rules embodying the changes to which reference is made. I hope this will be quite satisfactory.

Yours faithfully,
F. GOURDEAU.

THOMAS CÔTÉ, Esq.,
Secretary, Canadian Section
International Waterways Commission,
Seybold Building, Ottawa, Ont.

The Secretary was instructed to communicate with Mr. Chas. M. Hayes and to bring to his notice the changes which have been made in the 'Rule of the Road' for the Inland Waters of Canada.

The Secretary, also in compliance with a decision arrived at by the Commissioners at their meeting of the 15th of June last, in Toronto, informed the Commission that he had sent to the Mayor of Kingston, the President of the Board of Trade of Kingston, the President of the Montreal Transportation of Kingston and the President of the Harbour Commission of Kingston, an invitation similar to the one he had sent to the various public bodies of Montreal, for a meeting to be held in Kingston either on the 13th or 14th of July, and that no reply had as yet been received from any one of them.

The Secretary was instructed to communicate again with them by wire during the trip from Montreal to Kingston, informing them as approximatively as possible of the hour at which the Commission would reach Kingston, so as to give an opportunity to the public bodies there to present their views to the Commissioners if they did see fit to do so.

The Secretary stated that at the suggestion of Mr. James P. Mabee, Chairman of the Canadian section, he had sent to His Worship the Mayor of Toronto, the Secretary of the Toronto Harbour Commission, the President of the Toronto Board of Trade, His Worship the Mayor of Hamilton and the President of the Hamilton Board of Trade, an invitation similar to the one addressed to the Montreal and Kingston people, and informing them that dates for meetings in Toronto and Hamilton would be arranged later on and that due notice would be given them. It was resolved to fix dates for meetings in Toronto and Hamilton before the Commission did separate at Kingston.

The Secretary read the answer he had received from His Worship the Mayor of Toronto, as follows:—

MAYOR'S OFFICE,
TORONTO, June 26th, 1905.

'THOMAS COTÉ, ESQ.,
'Secretary, Canadian Section,
International Waterways Commission,
Ottawa, Ont.

'DEAR SIR,—I beg to acknowledge the receipt of your communication of the 23rd instant, regarding the meetings of the Canadian Section of the International Waterways Commission, to be held in Toronto in the near future, and will be pleased to place the same before the Board of Control at an early meeting.

'In this connection I may say that the City of Toronto would be pleased to place at the disposal of the Commission one of the large Committee Rooms in the City Hall, if other quarters have not already been arranged for, during the sitting of the Commission in Toronto.

'Thanking you for your letter, believe me,

'Yours very truly,

'THOMAS URQUHART,
'*Mayor.*'

In compliance with a resolution adopted by the Commissioners at the meeting held in Toronto on the 14th June last, the Secretary stated he had written to Mr. Chas. M. Dow, President of the Commissioners of the State Reservation at Niagara Falls and to Mr. J. F. M. Stewart, Assistant Secretary of the Canadian Manufacturers Association, informing them that the Commis-

sion would take up the question of the uses of the waters of Niagara river as early as practicable, and that it was expected that before concluding its investigation public hearings would be held, at which due notice would be given.

The Secretary gave communication of the following letter he had received from Mr. Hubert H. Macrae, representing the Electrical Development Company of Ontario, Limited:—

TORONTO, June 15th, 1905.

'THOMAS COTÉ, ESQ.,
'International Waterways Commission,
Ottawa, Ont.

'DEAR SIR,—I am instructed by the Directors of the Electrical Development Company of Ontario, Limited, to write you with reference to the pending proposal to construct a Dam at the head of the Niagara river where it flows in from Lake Erie, with the professed object of maintaining the mean level of that lake.

'The Company is engaged in the construction of a power plant in the Queen Victoria Niagara Falls Park, costing many millions of money.

'The works in question are constructed under a license from the Government of Ontario, guaranteeing an uninterrupted and sufficient water supply for a period of 110 years.

'It is self evident that any dam or obstruction in the Niagara river above the falls must affect more or less the supply of water to this Company, and it is therefore respectfully submitted to the Commission to fully consider the nature of this proposal, and afterwards to make such representations to the Commission as it may find necessary for the proper protection of its interests.

'Yours truly,

'W. H. MACRAE,
'Barrister.'

The Secretary stated he had replied to Mr. Macrae on the same lines as he had written to the Commissioners of the State Reservation at Niagara and to the Canadian Manufacturers Association.

It was resolved to fix dates for meetings at Niagara Falls, for the purpose of hearing all interested parties, before the Commission did separate at Kingston.

The Commissioners then proceeded to the City Post Office, where a special car put at their disposal by the Ottawa Electric Company was awaiting them. Being accompanied by Messrs. Arthur St. Laurent and Chas. R. Coutlée, both representing the Department of Public Works, they went first to Britannia-on-the-Bay, then passed through the city again and went to Rockcliffe Park and the Rifle Range. At six o'clock they returned to town.

At 7.15 p.m., the Commissioners, answering to an invitation sent to them by Honourable R. Dandurand, Speaker of the Canadian Senate, met again in the Official Chambers of the Speaker, in the Parliament Buildings, for dinner. The guests present were:—

Honourable R. Dandurand, member of the Senate for De Lorimier Division and Speaker;

The Right Honourable Sir Wilfrid Laurier, G.C.M.G., member of the House of Commons for the electoral district of Quebec East and Prime Minister of Canada;

Colonel O. H. Ernst of Washington, D.C., of the Corps of Engineers of the United States Army and President of the American section of the International Waterways Commission;
Mr. James P. Mabee, K.C., of Toronto, Chairman of the Canadian Section of the International Waterways Commission;
Mr. George Clinton, Attorney at Law of Buffalo, and Mr. George Y. Wisner, civil engineer of Detroit, Mich., members of the American section of the Commission;
Mr. Louis Coste, civil engineer of Ottawa, and Mr. W. F. King, Chief Dominion Astronomer, of Ottawa, members of the Canadian section of the Commission;
Mr. Thomas Côté, journalist of Montreal, Secretary of the Canadian section of the Commission;
Honourable H. R. Emmerson, member of the House of Commons for the electoral district of Westmorland, N.B., Minister of Railways and Canals;
Honourable Frank Oliver, member of the House of Commons for the electoral district of Edmonton, N.W.T., Minister of the Interior;
Honourable John Haggart, member of the House of Commons for the electoral district of South Lanark, ex-Minister of Railways and Canals;
Honourable George E. Foster, member of the House of Commons for the electoral district of North Toronto, ex-Minister of Finance;
Mr. Collingwood Schrieber, C.M.G., civil engineer and Deputy Minister of Railways and Canals;
Doctor Robert Bell, Acting Director of the Geological Survey of Canada;
Francis H. Clergue, manufacturer of Sault St. Marie;
Mr. Arthur St. Laurent, civil engineer of Ottawa.

APPENDIX 'Sa.'

Saturday, July 8th, 1905.

TRIP TO MONTREAL AND QUEBEC.

At 8.20 A.M., the Commissioners left Ottawa by the regular train of the Canada Atlantic Railway, and reached Montreal at 11.20 o'clock. They immediately drove to the Windmill Point Wharf, situated at the Western end of the Harbour of Montreal, and, at 12 o'clock noon embarked on board the new steamer 'Montreal' of the Richelieu & Ontario Navigation Company. They were received on board by the Honourable R. Préfontaine, Minister of Marine and Fisheries, and Mr. Robert Bickerdike, member of the House of Commons for the electoral division of St. Lawrence, of Montreal, and acting Chairman of the Montreal Harbour Commissioners. The Minister of Marine and Fisheries was accompanied by Colonel F. Gourdeau, Deputy Minister of his Department; Lieutenant-Colonel William P. Anderson, his chief engineer, and Mr. F. W. Cowie, Superintending Engineer of the St. Lawrence Ship Channel. Mr. Robert Bickerdike was accompanied by Messrs Jonathan Hudgson, Alphonse Racine W. E. Doran, James Crathern, L. E. Geoffrion and Alexander McPhee, members of the Harbour Commission; John Kennedy, civil engineer of the Harbour Commission; David Seath, Secretary and Mr. A. Archambault, Assistant Secretary, and Captain T. Bourassa, Assistant Harbour Master.

Among the gentlemen who had accepted the invitation of the Honourable Minister of Marine and Fisheries and of the Harbour Commissioners to accompany the members of the International Waterways Commission, there were:

Senators L. G. Power, J. R. Thibodeau, Wm. J. Macdonald, P. Poirier, J. A. Lougheed, Sir Mackenzie Bowell, K. C. M. G.; George T. Baird, John

Lovitt, Peter McSweeney, J. P. B. Casgrain, Robert Watson, F. N. Young, George McHugh, James Domville, Henry J. Cloran, James H. Ross, James McMullen and William Ross.

The members of the House of Commons present were :— Honourable R. F. Sutherland, Speaker of the House; George O. Alcorn of Prince Edward, Samuel Barker of Hamilton, John Barr of Dufferin, J. G. H. Bergeron of Beauharnois, John B. Black of Hants, Richard Blain of Peel, Gustave Boyer of Vaudreuil, Andrew Broder of Dundas, T. Arthur Burrows of Dauphin, Dr. E. L. Cash of Mackenzie, Peter Christie of South Ontario, Alfred H. Clarke of South Essex, Honourable John Costigan of Victoria, N.B.: John Crawford of Portage la Prairie, Joseph E. Cyr of Provencher, J.W. Daniel of St. John City, N.B.; Daniel Derbyshire of Brockville, J. A. Dubeau of Joliette, John Finlay of East Peterborough, D. Finlayson of Richmond, N.S.; Edmond Fortier of Lotbinière, Honourable George E. Foster of North Toronto, William A. Galliher of Kootenay, Victor Geoffrion of Chambly and Verchères, D. A. Gordon of East Kent, B. B. Gunn of South Huron, Honourable John G. Haggart of South Lanark, R.R. Hall of Peterborough, D. Henderson of Halton, J. J. Hughes of King's P.E.I.; Sam. J. Jackson of Selkirk, Alex. Johnston of South Cape Breton, J. B. Kennedy of New Westminster, F. R. Lalor of Haldimand, E. A. Lancaster of Lincoln and Niagara, A. J. Adamson of Humboldt, N.W.T.; O. S.Crocket of York,N.B.; Louis Lavergne of Drummond and Arthabaska, F. A. Laurence of Colchester, N.S.; J. E. E. Leonard of Laval, E. N. Lewis of West Huron, W. T. Loggie of Northumberland, N.B.; E. M. Maconald of Pictou, A. F. MacLaren of Nort Perth, R. J. Macpherson of Vancouver City, C. F. McIsaac of Antigonish, Thomas Martin of North Wellington, Henry H. Miller of South Grey, J. B. Morin of Dorchester, W.B. Northrup of East Hastings, George Parent of Montmorency, Camille Piché of Montreal St. Mary's, S. W. W. Pickup of Annapolis, R. A. Pringle of Stormont, E. Proulx of Prescott, D. Ross of Yale Cariboo, F. T. Savoie of Mégantic, John H. Sinclair of Guysborough, Wm. P. Telford of North Grey, Valentine Ratz of North Middlesex, Alexander Martin of Queen's, P.E.I., and R. D. Wilmot of Sunbury & Queen's. N.B.

The party also included the following gentlemen:—Chas. J. Smith, General Manager of the Richelieu & Ontario Navigation Company; Honourable W. A. Weir, Speaker of the Legislative Assembly of Quebec; Colonel A. F. Thompson, ex-member for Haldimand; ex-Mayor Fred. Cook of Ottawa; W.E. Gear, President of the Montreal Board of Trade; Percival St. George, civil engineer; N. S. Foley; Aimé Geoffrion, Solicitor of the Montreal Harbour Commission; L. A. Wilson, Henry Miller, F. B. McNamee; Aldermen L. A. Lapointe, L. A. Lavallée, Ls. Payette and W. Sadler, representing the City Council of Montreal; James Thom, representing the Shipping Federation of Canada; J. J. McGill, President of the Montreal Branch of the Canadian Manufacturers Association; Norman Wight, President of the Corn Exchange Ass'n; Henry Miles, President of the Business Men's League; Arthur St. Laurent and Chs. R. Coutlée, representing the Department of Public Works: Honourable James McShane, Harbour Master, and Jules d'E. Clément, Private Secretary to the Minister of Marine and Fisheries.

The Steamer 'Montreal' left Windmill Point Basin at 12.30 P.M., passed first along Alexandra Pier, King Edward Pier, Jacques-Cartier Pier and Victoria Pier. She, then, followed the central line of the Ship Channel, tested to 25.25 feet depth at low water. She passed gas buoy No. 195 near l'Ile Ronde, then gas buoy No. 191 opposite Tarte Pier now under construction, and went to the Northerly Boundary of the Harbour of Montreal at gas buoy No. 171 opposite Longue Pointe Church. She, then, commenced her return journey and landed her passengers at Victoria Pier at 4 P.M.

Luncheon was served on board during the trip down stream, Honourable R. Préfontaine presiding and having with him at the table of honour Sir Macken-

zie Bowell, Colonel O. H. Ernst, president of the American section of the International Waterways Commission; J. P. Mabee, K.C., president of the Canadian section, and Mr. Robert Bickerdike, M.P., acting president of the Harbour Commissioners. At the table to the right of the one presided over by the Minister of Marine and Fisheries sat Honourable George E. Foster, M.P., Hon. John J. Haggart, M.P., George Clinton and Mr. George Y. Wisner, members of the American section of the Commission. At the table to the left of the one presided over by Mr. Préfontaine sat Honourable Senator William Ross, Honourable John Costigan, M. P., W. F. King, Louis Coste, members of the Canadian section of the Commission, and Mr. Thomas Côté, Secretary.

The toasts of 'The King' and 'The President of the United States' having been honoured, Honourable Mr. Préfontaine submitted 'The Waterways' Commission,' and in doing so, he extended a hearty welcome to the commissioners, whose functions were of great importance to both the United States and Canada. The selection of these gentlemen was a mark of the confidence which had been reposed in their ability to assist the two countries in settling questions of international import. The eyes of the two countries were upon them, and great things were expected.

Colonel Ernst responded very briefly, referring to the friendship that had always existed between the United States and Canada, and remarking that the Chairman of the American section presided on American territory and the Chairman of the Canadian section on Canadian territory. He spoke of the splendid reception they had been accorded, and said they would do their duty with regard to the interests of both countries.

The toast was also acknowledged by Mr. Mabee and Mr. George Clinton, the latter remarking that every interest involved would be considered and the conclusions would be arrived at without any selfish motive whatever. He hoped that the improvement of the waterways would be for the benefit of both countries concerned.

Mr. Robert Bickerdike, on behalf of the Harbour Board, welcomed the visitors after which Mr. W. I. Gear proposed 'The Parliament of Canada,' expressing appreciation of the action of Honourable Mr. Préfontaine in showing visitors over the harbour occasionally.

Sir Mackenzie Bowell responded to the toast. He congragulated Montreal on the progress it had made, and in referring to the proposal to make it a national port, he said he had come to the conclusion that no expenditure of money, though it might appear extravagant in the eyes of many, was too great to accomplish that end. Canada, he went on to remark, was an integral portion of one of the great nations on earth, and her great ambition was not to build up a nation on the northern portion of this continent, but to built up a stronger ally of the British nation to which we belonged. He did not think there was a Canadian who did not rejoice that he was a British subject, and wished to remain so. This was no reflection whatever upon our neighbours to the south. There was room on this continent for two nations. Our only desire was to live amicably with our neighbours, whose progress, he hoped, we would not only emulate, but excel, if possible.

Honourable George E. Foster also responded to the toast. Referring to the work of the joint commission, he said there was a community of interest between the two countries, which was not divided by the 45th degree of latitude. He hoped that all difficulties would be eliminated, and a satisfactory settlement arrived at, as a result of which the St. Lawrence would serve as a means of tranportation for the products of the United States as well as of Canada. Why, he asked, should not some of the United States freight come down over our waterways, and some of ours come down over theirs? Out of the illimitable West would come, not many years distant, freights that would tax both countries.

Subsequently other toasts were drunk, including 'Trade and Transportation Interests,' proposed by ex-Mayor Cook, of Ottawa, and responded to by Lieut.-Colonel Gourdeau.

Mr. F. W. Cowie also briefly acknowledged the toast, after which Captain Bourassa proposed 'The City of Montreal.'

This was responded to by Alderman Lavallée.

Mr. C. J. Smith, General Manager of the Richelieu & Ontario Navigation Company, was then invited to speak, and touched on the need for a dry dock that would accommodate the river crafts. He said that the dry dock at Lévis would accommodate ocean vessels, but not river steamers, on account of their breadth of beam. Anything that could be done in that direction would be appreciated by the Richelieu & Ontario Navigation Company, which had some 26 steamers, and wished to put on the route a class of vessels that would be appreciated by the travelling public.

The Commissioners left at 7 p.m. for Quebec on board the new steamer "Montreal" as guests of the Richelieu & Ontario Navigation Company.

APPENDIX 'Sb.'

VISIT TO QUEBEC AND VICINITY, AND THE INSPECTION OF THE ST. LAWRENCE SHIP CHANNEL.

SUNDAY, July 9th, 1905.

On Sunday morning, after breakfast at the Chateau Frontenac, the Commissioners, accompanied by Messrs. C. J. Smith, General Manager of the Richelieu & Ontario Navigation Company, J. C. Rainboth of Aylmer, P. Q., and J. B. Baylor of Washington, D. C., both engineers engaged in the work of examination of the Monuments on the International Boundary line between the province of Quebec and the state of Vermont; Messrs. Arthur St. Laurent and Charles R. Coutlée, representing the Department of Public Works, drove to the Quebec Bridge now in construction west of the village of Sillery. The works were thoroughly visited by the Commissioners.

The works are being constructed by the Quebec Bridge and Railway Company.

This company was incorporated by the Dominion Act, 50-51 Vic., chap. 98 (1887), with powers to construct a railway bridge over the river St. Lawrence near Quebec, and to arrange the same for the use of foot passengers and vehicles, and to construct and operate lines of railway to connect with existing or future lines of railway on each side of the river.

By the Act 60-61 Vic., chap. 69 (1897), the powers of the company were revived, and the time for construction was extended to June 29, 1902.

By the Act 63-64 Vic., chap. 115 (1900), the time for completion was extended to June 14, 1905, and the company were further empowered to arrange for the placing of electric wires on the bridge and connecting railways, and for the passage of electric street railway or tram cars.

By the Railway Subsidy Act, 62-63 Vic., chap. 7 (1899), the grant of a subsidy to this company of $1,000,000 was authorized for a railway bridge over the river St. Lawrence at Chaudière basin, and by the Act of 1900, chap. 8, clause 10, it was made applicable, one-third to the substructure and approaches, and two-thirds to the superstructure.

On November 12, 1900, the company were admitted to contract for this subsidy work.

The site and plans of the bridge were approved by the Railway Committee of the Privy Council, and by an order in council dated May 16, 1898.

The structure is to be a cantilever bridge, composed of two approach spans of 220 feet, two anchor spans of 500 feet each, and a centre span of 1,800 feet from centre to centre of the piers. The under side of the bridge will give a height of 150 feet above high water. When completed, it will comprise a double track railroad, two lines for electric tramways, and two ordinary roads for vehicles and foot passengers.

Subsidy payments to the extent of $374,353,33 were made up to June 30, 1903.

By the Dominion Special Act, 3 Ed. VII., chap. 177, assented to on July 10, 1903, the name of the above company was changed to "The Quebec Bridge and Railway Company," with powers to construct lines of railway from the northern terminus of the company's bridge to the city of Quebec, also from the southern terminus of the said bridge to a point at or near the intersection of the Grand Trunk Railway at Chaudière Curve, or to some point on those lines near named section to connect with the line of the Canadian Pacific Railway. Other powers of a general commercial character were granted. The powers of the company for the construction of all its authorized works was extended to July 10, 1910.

Negotiations were had having in view to enter into agreement for the guarantee by the government of the bonds of the company, and for conveying to the government, at its option, the bridge, railways and property of the company.

Under the authority of an order in council, dated October 19, 1903, and under the same date, the company entered into an agreement with the government, accordingly, subject to ratification by parliament; and by the Public Act of the same year, 1903, chap. 54, such agreement, annexed as a schedule to the Act, was so ratified and confirmed, subject to the provision that the consent of parliament shall be given before the government exercise the right of taking over the company's property. It was further provided that the Governor in Council should have the right to appoint three directors of the company.

By this agreement the company releases the government from any claim for the unpaid balance of the subsidy of $1,000,000 granted to them, and the government agrees to guarantee the principal and interest of the company's bonds to the extent of $6,678,200, such bonds to be payable in 50 years from the date thereof, bearing interest at 3 per cent per annum, payable half-yearly, and to be a first charge, secured by a mortgage, upon all the company's franchises, tolls, and property of whatsoever kind, the mortgage to secure such securities to be made to a trustee or trustees approved by the Governor in Council and to be subject to like approval, the government to have the right to take possession of the undertaking and property at any time on one month's notice, paying the shareholders the amount of their stock at par value, not exceeding $265,585.70, with simple interest at 5 per cent, and an addition of 10 per cent on the par value of fully paid up shares, and assuming the approved obligations of the company for construction, operation and maintenance, according to the terms of the aforesaid bonds and the mortgage securing the same.

In pursuance of this authority there was executed, on February 1, 1904, between the Quebec Bridge and Railway Company, the Royal Trust Company (Montreal), and His Majesty, a mortgage trust deed, conveying to the said trust company as trustees all the property and franchises of the bridge company and providing for the issue of bonds to the extent of $6,678,200.

In pursuance of the requirements of the said agreement, the plans, profiles and specifications of the company's proposed railway works have been approved, as follows:—

By order in council of January 27, 1904, for the line from the northern terminus of the bridge to Champlain market, in the city of Quebec, and by an order in council of February 2, 1904, from the south terminus of the bridge to a point of junction with the Intercolonial Railway, 12,600 feet.

Under the terms of the company's aforesaid agreements in respect of the bond guarantee, the amount of the issue of bonds is to be fixed by the Chief Engineer's certificate as to the value of the work done and materials delivered, from time to time, on the company's works.

In brief, the bridge itself will consist of two main piers, two anchor piers and two abutments as masonry foundation, to be connected together by a steel superstructure 3,200 feet long, divided as follows:—two approach spans from abutment to anchor pier—two 500 feet anchor arm spans, and one 1,800 feet span over the channel.

The railway portion of the work consists in a line of railway commencing at a point on the Intercolonial Railway near Chaudière Curve to the south end of the St. Lawrence bridge, including a 800 ft. steel bridge on the Chaudière river, then from the north end of the St. Lawrence bridge to Champlain market in the city of Quebec, part of which lines will be double track, including all grading, fencing, bridging, station buildings, and generally all buildings and other works incident to a railway, also a connecting line starting west from the north end of the bridge through the parishes of Cap Rouge and Ste. Foye to the Canadian Pacific Railway line near Quebec.

The work completed to date (June, 1905) includes the bridge foundation or masonry substructure, completed at the end of the year 1902, at the cost of $1,216,000. The two main piers were sunk by the pneumatic caisson system, the one on the south side of the channel to a depth of 81 feet below high water. As far as the steel superstructure is concerned, the two approach spans are completed, and the falsework of the south span is also finished to receive the members of the cantilever. A traveller said to be of unprecedented capacity and dimensions has also been erected on the south anchor arm, is run by electricity and served by electrical hoisting machines, ready to proceed with the assembling of the substructure members, some of which weigh up to 100 tons. This traveller consists of a 54 x 103 ft. tower 212½ ft. high, and runs, on side tracks, about 160 ft. above highwater level.

The connection line from Chaudière Junction with the Intercolonial to the bridge on the south shore, say 2½ miles, is nearly completed. The Chaudière bridge was completed on the 20th June, 1905.

On the north shore of the St. Lawrence, the road way is well under way from the bridge to the east as far as Pointe à Pizeau (Sillery).

The bridge substructure and the connecting railways on both sides of the river have been contracted for by M. P. Davis; and the contractors for the bridge superstructure are the Phœnix Bridge Co. of Phœnixville, Pa.

The following is a rough summary of quantities of material contained in the bridge itself when finished.

Masonry and concrete in piers and abutments, 56,000 cubic yards.

Steel in cantilever and approach spans about 35,000 tons.

The Commissioners returned to town at 12.30 p.m.,

At 3 p.m., the Commissioners left on a special car of the Quebec Railway, Light and Power Co., for a visit to Montmorency Falls and vicinity.

The SS. 'Frontenac' of the River St. Lawrence Ship Channel, an inspection steamer of the Ship Channel Dredging fleet, having been placed to the disposal of the Commission by the Honourable Mr. Préfontaine, Minister of Marine and Fisheries, the six members of the Commission and the Secretary of the Canadian section, with a stenographer, embarked at the King's Wharf at 7p.m.

By instructions from the Minister of Marine and Fisheries, Mr. F. W. Cowie, Superintending Engineer of the Ship Channel, accompanied the Commission throughout, on the trip from Quebec to Kingston, in charge of the steamer. This steamer was built and fitted up for inspection purposes, as well as for towing and placing dredges, and general superintendence of the dredging operations for the improvement of the St. Lawrence. The ship was admirably adapted for the purpose of a thorough examination and complete inspection of the great river and its physical characteristics with reference to the question of transportation.

Leaving Quebec at 7.40 p.m. Sunday, July the 9th, at the commencement of the flood tide, the vessel steamed out through Quebec Harbour, affording the Commissioners a good opportunity of further examining the harbour facilities and of seeing the last of the gradually dying out commerce in square timber and of passing the site of Quebec bridge before darkness set in.

Navigation at night on this great river, with the gas buoys and system of range lights, was found to be perfectly simple and free from danger.

From Cap Rouge, the upper limit of the Harbour of Quebec, to the Richelieu Rapids, the river appeared to be from two to three miles wide. At the point known as the Richelieu rapids, opposite Deschambault on the North shore and Lotbinière on the South shore, the river itself continues to be wide, but, owing to the rocky batture extending out on either side, the main channel of the river is narrowed down to a width of about a quarter of a mile. With the falling tide, the current occasionally reaches the speed of eight or nine miles an hour. But at flood tide, the stream runs up for about four hours every tide.

Cap à la Roche was reached at midnight, and at 12.15 o'clock the 'Frontenac' tied up at King's wharf for the night.

Monday, July 10.—The start was made at 7 a.m. The first thing to be inspected was the more or less famous 'Cap à la Roche' channel. This is one of the points of difficulty, as well as of some dangers, in the construction and navigability of the channel of the river St. Lawrence. For three miles, where the natural depth is from eighteen to twenty three feet, the channel has been excavated in solid shale rock. The channel has a minimum width of three hundred feet, widened to four hundred and fifty feet at the bends, and is magnificiently buoyed and lighted for navigation. The current is strong at ebb tide, but owing to the easy lines of the channel and the magnificent aids to navigation, this part of the channel has been remarkably free from accidents. A semaphore, situated on the high bank of the river, indicates during daylight the depth of the water, in feet and inches, in the channel, being visible at a distance of from six to eight miles.

Continuing on up the river, a short stop was made at Batiscan wharf, and very soon afterwards the Ship Channel fleet of dredges was visited and examined in detail.

Dredge No. 2 (Laurier) was found to be working at Pointe Citrouille, about sixty four miles above Quebec. The material was hard-pan and gravel. The buckets of this dredge are built up, with steel teeth and alternate buckets. Owing to the hard material and the fact that the cut consists of a series of lumps, the dredge was not working its full capacity.

The next dredge to be visited was No. 6 (The Baldwin). This machine was working directly opposite Champlain village in very hard material consist-

ing of hard-pan and boulders. The feature of this dredge is the use of cast steel lips on the buckets and cast steel teeth; the teeth being forged to a point and tempered at the Sorel Government Works.

Working close ahead of No. 6, the steel dredge No. 5 (Aberdeen) was also inspected. The buckets of this dredge are of heavy cast steel, with four forged teeth on each. In the same hard material this dredge was found to be making wonderful progress.

After a run of several miles, dredge No. 4 (Minto) was reached, working opposite Bécancourt. This dredge has also a steel hull and cast steel buckets for rock or other hard material.

The next of the series working at Bécancourt was found to be dredge No. 5 (Lafontaine). This dredge, according to Mr. Cowie, was the best and most efficient of any of the elevator dredges. With steel buckets, a well built hull and an excellent crew, this dredge holds the record of the elevator fleet.

The last of the series working on the Bécancourt channel, No. 1 (Laval), was found to be stopped and a large stone lifter moored alongside, removing boulders which were too large for the dredge to lift. This stone lifter is a vessel with a hull almost as large as a dredge and having a square well in the centre. Boulders are located by means of long poles. A screen to check the current is lowered just in front of the well. When a boulder is located, the stone lifter is placed directly over it and the large automatic grips, capable of lifting boulders of fifty tons, are lowered down open, to the bottom. As soon as the hoisting commences, the grips close with such force that, if they do not completely enclose the boulder they may grip one corner of it and actually pull it out of its bed. On the deck of this stone lifter there were boulders which had been lifted up that same morning. Several of them weighed from three to five tons, one large one being lifted in the presence of the Commissioners.

From the foot of Lake St. Peter to Quebec, all the material to be dredged is hard, consisting of shale rock, hard-pan with embodied boulders, and shoals consisting entirely of boulders and gravel. No indication was found of any filling up taking place, the bed of the river appearing to be perfectly stable and the dredged channel, when completed, permanent.

Considering the conditions, the hard material and the great depth at which the dredging was being made, most surprising progress was observed. The fleet was found to be composed of a magnificent number of very powerful vessels.

Here follows a statement showing the details of dredging and cost per cubic yard, during the fiscal year ended June 20th, 1904:—

Dredge *Lady Aberdeen*, Total cost of operations during fiscal year, $35,827.24; number of days in operation, 176; cost per day, operations of dredge and plant, $203.56; total coast of operations, $35,827.24; total cubic yards, 649,400; average cost per cubic yard, 5-51/100.

Dredge *Lady Minto*. Total cost of operations during fiscal year, $37,002.17; number of days in operation, 124; cost per day, operations of dredge and plant, $298.40; total cost of operations, $37,002.17; total cubic yards, 306,340; average cost per cubic yard, 12-07/100.

Dredge *Laurier*. Total cost of operations during fiscal year, $35,883.24; number of days in operation, 180; cost per day, operations of dredge and plant, $6,199.35; total cost of operations, $35,883.24; total cubic yards, 317,950; average cost per cubic yard, 11-28/100.

Dredge *Laval*. Total cost of operations during fiscal year, $32,615.17; number of days in operation, 141; cost per day, operations of dredge and plant,

$231.31; total cost of operations, $32,615.17; total cubic yards, 217,150; average cost per cubic yard, 15-01/100.

Dredge *Lafontaine*. Total cost of operations during fiscal year, $36,143.92; number of days in operation, 178; cost per day, operations of dredge and plant, $203.05; total cost of operations, $36,143.92; total cubic yards, 752,400; average cost per cubic yard, 4-81/100.

Dredge *Baldwin*. Total cost of operations during fiscal year, $36,959.23; number of days in operation, 136; cost per day, operations of dredge and plant, $271.75; total cost of operations, $36,595.23; total cubic yards, 320,880; average cost per cubic yard, 11-51/100.

Dredge *J. Israel Tarte*. Total cost of operations during fiscal year, $62,527.62; number of days in operation, 106; cost per day, operations of dredge and plant, $589.88; total cost of operations, $62,527.62; total cubic yards, 2, 055,140; average cost per cubic yard, 3-04/100.

A short stop was made at Three Rivers at 12.15 p.m., and the next point of interest was Lake St. Peter.

The river at Lake St. Peter widens out to a width of nine or ten miles, with a natural depth at low water of about ten feet. The first idea of improvements to the River St. Lawrence had for its object the deepening of Lake St. Peter.

Work was commenced in 1847, and from the first intention, of dredging to permit the passage of a vessel of 500 tons, to the present time when improvements are being made to permit the passage of vessels of 15 thousand tons, operations have never been stopped for a period of more than 11 years at any time. The material is tough greasy blue clay. It cuts like cheese. Water washing over it is scarcely discolored. The banks remain permanent as dredged and no filling in whatever takes place. The constant washing of the propellers, in the centre of the channel, has a tendency to slightly increase the depth in the middle, but most of the material is carried away or finds a lodgment directly in the corner of the dredge cut.

The hydraulic dredge No. 7 (J. Israel Tarte) was found to be working near the lower end of Lake St. Peter. This vessel was engaged on curve No. 3, opposite Pointe du Lac. This curve is being made with a radius of 2½ miles, and a width at the widest place, of 650 feet. The dredge was found to be working over that width without any trouble. The depth, being excavated in the old channel, was about four feet, and the widening on the bank to the depth of about 12 feet. The features of this dredge are:—Its large capacity; its magnificent cutter; the system of control by splendid winches; the lately installed Jones Underfeed Stokers, on the boilers; the system of discharge, through a long floating pipe.

The average quantity being excavated by this dredge, was found to be between 15 and 25 thousand yards per day, or about half a million yards per month.

The whole fleet of ship channel dredges excavate at the rate of about a million yards per month, at a cost of about 3c per cubic yard in soft material, to about 15c per yard in hard material, or an average of about 6c per cubic yard, for the season.

The next stop was made at Sorel, at 5.30 p.m., at the Works of the Marine and Fisheries Ship Yard. The Commissioners were received by Mr. G. J. Desbarats, Director of the Ship Yard, and shown over the establishment. A new large sea-going-steel-hopper-elevator and suction dredge, built for the Public Works Department for the Maritime Provinces, was found to be just completed.

On the recommendation of the Shipping Interests of Montreal, improvements are to be made to the channel below Quebec. There is now, at one point, only a depth of 20 feet at low water, and all deep draught vessels have to pass that point with the tide. A thorough examination was made in 1903 and 1904, with a view to dredging the shoals at the North traverse and the adoption of that channel for navigation. The Royal Commission on Transportation examined both the proposed North Channel route and the present South Channel. After consultation with the Transportation Commissioners and with the Pilots and the Shipping Interests, Mr. Cowie recommended that the present South Channel route be first dredged and then, later on if required, the North Channel may also be improved.

Acting upon this recommendation, the Honourable Minister of Marine and Fisheries has obtained the necessary appropriations from Parliament for the construction of the necessary plant for this work. The dredge is to be designed under the supervision of Mr. Cowie, and will be built entirely at Sorel. Preparations have been made for the immediate commencement of the large steel hull, and it is expected, that before the end of the season of 1906, this large sea-going-hopper-hydraulic-dredge will be ready for operations.

The estimated cost of the dredge is $350,000, and its carrying capacity in the hoppers 2,000 cubic yards.

The *Frontenac* remained at Sorel all night, the Commissioners having a thorough discussion during the evening, on the lines of the proposed meeting in Montreal for the next day.

Tuesday, July 11th—Arrangements were made for a start at 4 a.m., so as to reach Montreal at 9 o'clock. A dense fog was found to be on, precluding any idea of navigating by boat. It was decided to go to Montreal by train leaving at 7 a.m. At 6.30 p.m., however, the fog lifted and a start was immediately made on the *Frontenac*.

The Division of the Ship Channel, between Sorel and Montreal Harbour, has been all completed, as far as the improvements for the thirty foot channel and the Aids to navigation are proposed. An opportunity was given the Commissioners of inspecting thoroughly the lines and capacity for navigation of the projected 30 foot channel from Montreal to Quebec and the Gulf.

At Vercheres the fog was again encountered, and the *Frontenac* continued on with difficulty, but after an hour the weather cleared up.

Montreal was reached at 10.30 a.m., the Commissioners reaching the offices of the Board of Trade exactly at eleven o'clock, hour of the meeting.

APPENDIX 'Sc.'

Session of the International Waterways Commission held at Montreal, in the Council Chambers of the Board of Trade, July 11th, 1905, at 11 o'clock a.m.

There were present at this session the following:

All the members of the Commission, as follows:—

James P. Mabee, K.C. of Toronto, Chairman; Col. O. H. Ernst, of Washington; George Clinton, of Buffalo; Prof. George Y. Wisner, of Detroit; W. F. King; Louis Coste, C.E.; Thomas Cote, Secretary Canadian Section.

Representing the City: His Worship, Mayor Laporte; Representing the Board of Trade: Wm. I. Gear, President; F. H. Matthewson, 1st Vice-President; R. M. Ballantyne, 2nd Vice-President; James Thom, Treasurer; Geo. Hadrill, Secretary.

Representing the Harbour Commissioners:

R. Bickerdike, M.P., Jas. Crathern, L. E. Geoffrion, Alex. McFee, W. E. Doran, John Kennedy, Chief Engineer, David Seath, Secretary.

Representing La Chambre de Commerce: H. A. A. Brault.

Representing the Shipping Federation: Hugh A. Allan, President; J. R. Binning, R. W. Reford. Thos. Robb, Manager.

Representing The Dominion Marine Association: Jas. Cuttle, President; Chas. J. Smith.

The following officers of the Dominion Government were also present: Col. Anderson, Chief Engineer Marine Dept., F. W. Cowie, Superintending Engineer of the Ship Channel, Arthur St. Laurent, of the Public works Dept.

A. Monroe Grier, representing the Canadian Niagara Power Company.

H. H. Macrae, representing the Electrical Development Company of Ontario.

Banker R. Paine, representing the Ontario Power Company of Niagara Falls.

James Wilson, representing the Ontario Government and Queen Victoria Niagara Falls Park Commission.

The Commission was called to order by Chairman Mabee at 11 o'clock A.M. Whereupon Mayor Laporte extended the following welcome to the Commissioners.

Mayor Laporte. Mr. Chairman and Members of the International Waterways Commission:—

On behalf of the citizens of Montreal, I have the honour to welcome you to this city and to thank you for affording the shipping and commercial interests of the port an opportunity of presenting to you its claims for consideration as to the effect upon our national waterway, of any works which may be undertaken on the Great Lakes.

Your visit of Saturday last to our harbour and your journey on the river between here and Quebec will have given you some idea of the vast works undertaken by the Montreal Harbour Commission at its own expense and by the Dominion Government out of the national funds in the interests of trade and navigation, and I am sure that you will have perceived how vital it is to the country in general and the port of Montreal in particular that nothing should be done that in the slightest degree would impair the usefulness of those harbour and channel works or of the canal system above this port.

Large as is the trade of the port of Montreal it is but small compared to what it must be when this great Dominion is more generally settled and the development and improvement of our great river trade route is a duty that has always been foremost in the hearts and minds of the citizens of Montreal, and in later years, of the people of the country in general.

As the Harbour Commissioners, the Board of Trade, La Chambre de Commerce and the Shipping Interests will, I understand, submit their views to you on the subjects I have mentioned, I need not say more than that I have every confidence that you will leave Montreal fully convinced of the claim of the St. Lawrence route to be considered in any works contemplated for the control of the water levels of the Great Lakes.

Chairman Mabee.—Mr. Mayor: On behalf of my fellow Commissioners, I beg to extend to you our sincere thanks for the kindness that you have displayed in presenting us with this very elegantly worded address.

As this was purely a business meeting, and as we are a little beyond the hour now at which it was intended to open it, and as I shall have an opportunity to reply before the meeting closes, as well as some of my brother commissioners, to express our views somewhat more fully upon the very important subject

matter of this inquiry, I will not take up time at this moment in replying in detail to the matters referred to in this address.

A programme has been arranged, and these different bodies are on hand, and later on, during the discussion, I shall, as I said, have an opportunity, I trust, of saying something with reference to the subject matter of this address.

The representatives of the Board of Trade, I believe, through the head of the President, will open the discussion with reference to which this meeting has been called.

Mr. Wm. I. Gear, President Board of Trade.

Mr. Chairman and Gentlemen:—It gives me very great pleasure to-day to welcome the International Waterways Commission in these rooms. We feel that you have given us an opportunity of expressing our opinion regarding the waterways which are of interest to us all. But before we can thoroughly go into the question of the waterways and what might be the result of any holding back of the water at Lake Erie, I would like to know Mr. Chairman, if you would give us some idea of what is intended to be done. I understand that a report was prepared by a Deep Waterways Commission, appointed by the President of the United States, and doubtless this Commission has made a full report. I would like to ask Mr. Wisner, with your permission, some questions in regard to this report, so that we may understand entirely the position in which we are at present. As we understand this position, I mean, in Section 4, it delegates to you, 1st: to investigate and report upon the conditions of our own waterways adjacent to the boundary line between the United States and Canada; also upon the maintenance and regulations of suitable levels; also upon the interests of navigation by reason of the diversion of these waters from, or change of their natural flow. Further, to report upon the necessary improvements to regulate such diversion, and to make such recommendations for improvements, and regulations as shall best subserve the interests of navigation in said waters. And you shall further report on the advisability of locating a dam at the outlet of Lake Erie with a view to determining whether such dam would benefit navigation, and if such structure is deemed advisable, shall make recommendations to their respective governments, looking to an agreement or treaty, which shall provide for the construction of some method, and shall make an estimate of the cost thereof. If it meets with your approval, Mr. Chairman, I would like, with your permission to ask a few questions in regard to this, so that we might,—not only we,—but all the citizens of Montreal, shall receive some idea of what is proposed in these works at the foot of Lake Erie.

Chairman Mabee—We have not the slightest objection Mr. President, to the course that you suggest being pursued. I might however preface it by the statement that there is, at this moment, no definite plan of any kind before this meeting. We are at the threshold of this inquiry. Before dealing with any proposed works or any suggested works, it was suggested that we should discuss the whole situation with the business and shipping interests of this city, and of the St. Lawrence. It is true, as you say, Mr. Wisner two or three years ago made a report upon one particular part of the work. He had not in view the down stream interests, nor indeed, is any plan yet before the members of the commission, but we regard it eminently fitting and proper, for you to ask him for information inasmuch as Mr. Wisner has made a careful study, and did make a report regarding one particular plan, which he will explain, and with Mr. Wisner's permission, I would request that he should do so. Whether you desire to put it in the form of a series of questions or whether Mr. Wisner would prefer dealing with the report as a whole, and then if he did not happen to cover the particular matters you desire, to interrogate him upon, I suppose perhaps this is something which might well be left to Mr. Wisner.

Mr. Wm. I. Gear—The first question I thought of asking Mr. Wisner was, to give us a brief outline of the plan he reported upon. I presume that is the basis upon which the commission is sitting.

Prof. George Y. Wisner—Before describing the plan, it might be well to make a few remarks in regard to how the investigation came to be started.

In 1894, I think it was, at a meeting of what was known as the International Deep Waterways Association, held at Toronto, an association which had been formed for the purpose of impressing upon the legislature to a certain extent, the importance of improving our waterways, amongst the things which came before the Toronto meeting was the matter of improving the channels or waterways and harbour entrances and so forth of Lake Erie by means of holding out the low water surfaces. A resoultion was passed for further report at the next meeting, which was held at Cleveland in 1894. A report was submitted there and pretty thoroughly discussed, and, due to the recommendations made at that meeting, no doubt, that when the Deep Waterways Commission, whieh was appointed in 1897, in their instructions was incorporated a clause regarding an investigation to be made into the feasibility of improving the Lake Erie channels, by holding up the waterways. In brief that is the origin of the work. The speaker was a member of that commission, and to a large extent, made those investigations and later report.

As is well known Lake Erie is shallow, and the depth of ships that are being made to-day is such that in order to improve the harbour entrances in some channels, it has been necessary to excavate in the bed of the lake itself. These exeavations are often not practically wiped out, but very badly deteriorated by storms coming in and filling up, which is one of the main reasons that so much of a study was given to the possibility of improving by holding up the water surface, and thereby increasing the depth rather than excavating the depression in the bed.

This investigation was such that the members of the Board regarded it as a feasible one, that is, not speaking of any respective damage on any other lakes around, that was deemed feasible, and that being the case, in order to find out the comparison between the benefits to be derived from an improvement of that kind, it was thought necessary to make a set of plans on which to base estimates of cost. This was done, and I will say, that to the best of our ability, we made the location at the foot of the lake which we thought was best adapted for solving the situation, and we made designs, and in fact not only the designs, but practical working plans for damming, regulating works, gates and everything else, to hold the low water stage at any plane we pleased from below the mean stage clear up to the highest stage, rather than by the lake, if it was found advisable to do so.

A comparison between the appparent benefits to Lake Erie channel showed very clearly that if the damages which were likely to arise from flooding the land were not anticipated, it would probably be a good thing to have carried out, but it is distinctly stated in that report, and it was the opinion of all three members of the commission that absolutely nothing could be done except by the common consent of the two countries, that is, Canada and the United States; and attention is called, in this report, to this fact, that it is an international problem, and if any recommendations are made, it should come from an International Commission; and in all probability, the recommendations in that report had something to do with the clause being incorporated in the Act making the investigation as to improving the channels of Lake Eric, by regulating one of the features of the present International Commission.

I wish to say in regard to that that I believe there is not a man on this commission who will not turn down this proposition as not being advisable, just as soon as they find, whatever may be the results, that it is going to be detrimental

to the lake channel, no matter whether they belong to Canada or the United States.

I want to say in regard to this, that at the time this investigation was made and a report submitted that data did not exist relative to the flow of the St. Lawrence river sufficient to make an accurate determination of what the effects might be on the St. Lawrence channels. Since then a large amount of investigation has been made relative to the discharge of the St. Lawrence river, and we are in hopes, that the data that now exists will be sufficient; we have not gone into sufficient details to know yet, but we hope that it will be sufficient to make a fair determination of what the effect of regulating the levels of Lake Erie may be upon the levels of Lake Ontario and upon the St. Lawrence channels.

Now, in regard to the level to which it is proposed to raise the level of Lake Erie, I wish to say that we used the extreme high water in a good deal of discussion, for the reason that at that stage complete regulation could be had, that is, that a practically fixed plane could be maintained, but we were well aware that when an investigation should be made with reference to the advisability of constructing such work, that a plane much lower than that would have to be adopted, as the practical plane of regulation, as it would flood the docks at Buffalo; that is, they would be so high as to do considerable damage. It would overflow considerable of the riparian lands along the lake shore. Possibly the effect on Lake Ontario and the St. Lawrence might be such that complete regulation at high water stage would be out of the question entirely.

It was therefore deemed impossible to state what the plane should be, because it is a matter which concerns both countries, and it was the views of that commission, and so stated in the report, that whatever plane should be adopted for regulation of Lake Erie, in case it was done at all, would be one adopted by some such commission as the one which has been recently appointed. I mention this for the reason that the effect on Lake Ontario and on the St. Lawrence channels will depend largely upon what stage is adopted in Lake Erie. This regulation on Lake Ontario will be due to the change in the amount of storage in the Lake Erie basin. If we make a complete regulation there will be no storage. If we should raise it one-half and take out the low water plane, the amount of storage would be much greater; and for this reason no determination of the effects on Lake Ontario levels, and on the St. Lawrence can be determined until we find what stage is a practical one for Lake Erie itself.

In conclusion I wish to say that this commission has already taken steps to investigate that part of the problem and to collect data, and as soon as that is done, the other branches of the question will be taken up consecutively, and I hope satisfactorily discussed, and everything will be done open by and above board, that the people of the St. Lawrence valley can rest assured that nothing will be done detrimental to those waterways.

Mr. GEAR—I want to thank Mr. Wisner for giving this brief outline of the problem. I also have to thank him for the expression of fairness on the part of the Commissioners from the other side of line Forty-Five. They are as deeply interested, it seems to me, in the waterways of the St. Lawrence, almost, as we are, and therefore this expression of fairness comes to us and we appreciate it all the more.

Might I ask Mr. Wisner a few questions? Mr. Wisner, stated that a supplementary report had been issued. Was such a supplementary report issued?

Mr. WISNER—There has been no supplementary report. There has been newspaper discussion by various newspapers, but nothing official.

Mr. GEAR—I understand from your remarks that the purpose of the works at the lower end of the Lake Erie is to elevate the water, or rather to keep the water elevated on Lake Erie, and to hold it back at low water stage.

Mr. WISNER—Yes, sir.

Mr. GEAR—May I ask you what will be the character of this structure?

Mr. WISNER—The structure outlined by the Deep Waterways Board, whether that would be acceptable to any other engineer that would be called to make the design, I don't know,—but taking that as a basis, the structure was a long submerged weir of sufficient length that at times of low water, the entire low water flow would pass over the crest of this weir at the plane at which it is regulated. Then as the supply to the lake increased, that is, at times of higher water, greater inflow, there was a system of regulating gates, such that one or all of them could be raised, and when they were all raised, it was capable of passing the entire high water flow.

Mr. GEAR—I presume the organization that undertakes the administration of these works would be international.

Mr. WISNER—They would have to be.

Mr. GEAR—What I want to know is, what would be the extent of the changes in the cross section area of discharge from the present natural area of discharge to the artificial area, in both high and low water. Have you that data?

Mr. WISNER—I don't know if I quite understand the question.

Mr. GEAR—The point I want to arrive at is—I am not an engineer—is the extent of the changes, and the cross-section, say, of discharge,—take the natural discharge of to-day as compared with that which would be the artificial area in the outlet of the lakes after the construction of these works?

Mr. WISNER—The works are not in the head of the river exactly. They are a slight distance above, where the distance across the foot of the lake is about 4,000 feet. That is put up there to get a sufficiently long weir, that the overflow will be largely increased by slight changes in elevation. The cross-section of the outlet down in the rapids, so to speak, will not be interfered with unless it is found advisable to lower the high water plane of the lake. The width at the head of Niagara river is only about 1,600 feet. By a small amount of work, of increasing the width of that cross-section, the actual high water plane of Lake Erie can be kept at a lower stage than it is in nature; but that is merely mentioned in the report, and not taken up to any extent.

Mr. GEAR—Isn't it a fact that if you create a weir across that 4,000 feet, you will decrease the area of discharge to the extent of the surface of that weir?

Mr. WISNER—At that place.

Mr. GEAR—What would be the two areas, the natural area of to-day and the area after the construction of that weir?

Mr. WISNER—I couldn't tell you that, but I would like to say in regard to that, that this distance of 4,000 feet, a considerable depth to-day, is such that the velocity of flow is very small. The water is held up in the lake; it is higher that it is immediately below, so that it is the simple inflow of water over the still water of the lake. The cross-section is made sufficient to take care when the gates are all closed, of the low water flow, and at the higher stages these different gates are opened so that the actual high water surface would remain the same as it would be under present conditions.

Mr. GEAR—Look at it commercially. It seems to me if you construct a weir, suppose you have the gates,—the gates would be closed at certain periods of the year; you construct a weir for certain surfaces. That surface would decrease the natural outflow of Lake Erie, will it not?

Mr. WISNER—If put in the restricted section.

Mr. GEAR—It will when the gates close?

Mr. WISNER—It will restrict it there, certainly.

Mr. GEAR—Then you have the intention of decreasing the low water discharge by the permanent construction?

Mr. WISNER—At that point, yes.

Mr. GEAR—Would the works be of such a nature that there would be no possibility of floods during the high water seasons of Lake Erie and Huron?

Mr. WISNER—Danger of flood in Lake Erie and Huron?

Mr. GEAR—Yes?

Mr. WISNER—The plan contemplated complete control, and as we have not discovered it, it will not take the high water stages of these two lakes.

Mr GEAR—If I understand you correctly in your description, there is a danger of flooding.

Mr. WISNER—Not a danger of flooding but the damage only comes in in the fact that the falls at Buffalo have probably been constructed for some certain elevation, and the water should have to have gates above mean stage.

It is simply a question how high this low water plane can be raised without doing damage on the wharfs at Buffalo, that is, by holding it up so that it is not so economical for handling vessels and trade at the wharfs.

Don't understand me as saying that we are going to raise the water at the high stage above low any higher than it is at present.

Mr. GEAR—The point I want to make is this: If you create a weir at the outlet of Lake Erie, thereby decreasing the outlet area as you have stated you will do by the size of the weir, there is a danger of high water flooding the shores of Lake Erie.

Mr. WISNER—There is no more danger of flooding Lake Erie than at present, because the high water plane will not be raïsed over what it is in the state of nature.

Mr. GEAR—What season of the year did you, in your report, consider that the gates for neutral structures should be opened and closed?

Mr. WISNER—The method of handling the gates contemplated that after the close of the season to let the water drop sufficiently in order to get control of it, and in the spring of the year, the water would be kept up to this plane, whatever it may be, then if the upper lake system indicated at least a normal or greater discharge you could tell that from the gauges on the different lakes, the gates will be thrown open, so as to take care of the discharge in advance of any high stages.

In other words, when the gates are all opened, the volume of water which will pass the regulating works is equal to the highest known inflow that we have been able to find in Lake Erie.

Mr. GEAR—You just now stated that these gates would be open after the close of the season. What season have you reference to?

Mr. WISNER—After navigation season.

Mr. GEAR—What season do they close up in the lakes?

Mr. WISNER—Sometimes in the end of November we have vessels coming down there.

Mr. GEAR—It will not allow the water to go away until after November and December, unless you have a superabundance of water in Lake Erie?

Mr. WISNER—It will be held up so as to take care of these excessively low stages which occur in November and December.

Mr. GEAR—What are the probable effects on Lakes Erie, Huron, Georgian bay and the St. Lawrence river?

Mr. WISNER—The investigation indicated that the control in Lake Erie, in case of a rise at a higher plane than the low water plane, the effect on Lake Huron and Michigan would be one-third of the height of the raise of the low water plane in Lake Erie. For instance, if we put it at three feet, so as to get it into good round numbers, it would make a foot in Lake Huron; if we made it only one foot, practically four inches in Lake Huron.

Mr. GEAR—How high did your proposed scheme intend to hold the water back, your late scheme?

Mr. WISNER—The plan you mentioned?

Mr. GEAR—Yes.

Mr. WISNER—That was never fixed at all.

Mr. GEAR—In that report did you not state you proposed holding the water back in Lake Erie to a certain depth?

Mr. WISNER—I stated in that report that complete regulation would require holding it up almost to a high water plane. And whatever plane might be adopted, when found as a matter of advisability, would have to be determined by the International Commission.

Mr. GEAR—You have given a figure in that report?

Mr. WISNER—Yes.

Mr. GEAR—What is your figure ?

Mr. WISNER—That is about six inches of the highest water ever known in the lake.

Mr. GEAR—What is the highest water ever known in the lake?

Mr. WISNER—The point we used, 574.5 above tide water, and I think two or three years it went just a shade above; but, understand, that is not the plane that was contemplated regulating to.

Mr. GEAR—At page 24 of your report, you say: 'In the opinion of the Board, the result of these changes would be to raise the low water stage about three feet, in Lake Erie.

Mr. WISNER—Complete regulation would do it.

Mr. GEAR—Your structure as proposed in that report, would raise it three feet. Your proposed structure would raise it three feet.

Mr. WISNER—If left closed, it would, undoubtedly.

Mr. GEAR—That would be three feet in Lake Erie and two feet in Lake St. Clair; one foot in Lake Huron?

Mr. WISNER—Yes.

Mr. GEAR—You purpose keeping that at within .6 of the flood level?

Mr. WISNER—No. It is a system of regulation which is complete for any plane that you wish to hold the water at. While the regulation works will maintain a fixed level at that low water level, it will also by leaving the gates open, leave a fluctuation between the natural high water plane, below which the low water is not allowed to drop.

Mr. GEAR—What is the extreme variation of Lake Erie?

Mr. WISNER—I think about 3·5 feet; something like that I would not be accurate on that.

Mr. GEAR—Your report gives 4 ft. 6 in. the extreme?

Mr. WISNER—It has been a long time since I looked these things up. I will give it to you as clear as I can.

Mr. GEAR—You dont' know what is the period of high water in Lake Erie?

Mr. WISNER—574·5.

Mr. GEAR—What period of the year?

Mr. WISNER—The high water changes, sometimes. But along in the fore part of July, sometimes in June.

Mr. GEAR—Do you propose any other supplementary works in connection with this dam on Lake Erie?

Mr. WISNER—The one which I mentioned, in case they wanted to lower the high water plane of the lake, it could be done by enlarging the outlet at the rapids themselves.

Mr. GEAR—Nothing below Niagara river?

Mr. WISNER—We didn't take up anything there. It is mentioned in the report that on the St. Lawrence, in case that regulation should be desirable on

the St. Lawrence river, that there is a very natural condition at the head of the islands where such things could be put in. When this commission comes to consider this whole matter on a broad basis, it may be found desirable to give Montreal a little better water than she gets in nature.

Mr. GEAR—Didn't you talk of making some supplementary works at the rapids?

Mr. WISNER—Those are the ones I am speaking of.

Mr. GEAR—I understood you to say that the benefits to be derived by the elevation of this water, would be the deepening of the harbours on Lake Erie, raising the water in Lake St. Clair, and also in Lake Huron, and you naturally would raise the water in the St. Clair and Detroit rivers?

Mr. WISNER—Yes.

Mr. GEAR—I suppose the main benefits, at any rate, to-day, would accrue to the United States?

Mr. WISNER—Yes, well, largely so, because a large proportion of the shipping using those channels are United States vessels.

Mr. GEAR—And the large ports along the south side of the shore of Lake Erie would be the ones that would derive the benefits to-day?

Mr. WISNER—Principally so.

Mr. GEAR—So that we may look at it that the benefit to be derived from the works would naturally fall to the United States?

Mr. WISNER—That would be the case at present, but we hope to see Canada able to want the same thing.

Mr. GEAR—I wish to thank Mr. Wisner for his kindness in answering these questions, and I hope I have not worried him, but I thought we ought to get some of these questions answered, so that we may more clearly understand the purpose of the works at the foot of Lake Erie.

Coming more particularly to the point we have to raise before you to-day, Montreal, as you know, enjoys a very unique position on this continent. We find her at the head of what we call ocean navigation, though we have a very long river route. We find her at the foot of canal navigation, which you may say, commences at the upper end of Lake Superior, reaching to the seaboard at Montreal. I look upon this city as being a great coming national port of the Dominion. The Metropolis of Canada, where we have immense wealth centred, and where, I think, our commercial men are always found to be prepared to foster any good scheme for the advancement of Canadian interests.

The exports of this city, throughout the year, amount to some $58,000,000; the imports some $76,000,000, or a total of $134,000,000, about 30 p.c. of the total imports and exports of the Dominion. Our population here is growing rapidly, and we will hear in a very short time, of Montreal with its suburbs having a population of half a million people. We are rapidly climbing there at present, and we think the time is not far distant when we can claim this population.

It not only is at the foot of what we call our water communication, but Montreal also holds the unique position of being the terminus of what we may say the greatest railroads crossing Canada.

I might be allowed to refer to where our exports mainly come from: from the provinces of Ontario and Manitoba, the western provinces, the Northwest Territory, even out to British Columbia. Nor are we even localized to our own country, but the northern men of the United States seek this route as being one of their main arteries for their exports, from the point of production to the point of consumption on the other side of the Atlantic.

As to what will be the eventual growth of these exports, we are almost afraid to quote figures, they seem to be so big; but when you take the immense area we have in Manitoba, and the Northwest, estimated at some 240,000,000 acres, and take the products that are likely to be yielded from that immense amount

of territory, you can get at some rough idea of the commercial point of which Montreal occupies in being the great export emporium of the whole Dominion of Canada.

Now, the mode of conveyance for all those vast exports at present flows through Montreal, and which are to come to us in the near future, are through our waterways and railways.

The railways of Canada are over 19,000 miles and all those roads seek this terminus. Now, I have mentioned the railways in passing to show you that the waterways of Canada are just as important to the railways east of Montreal as what the water connection is west of Montreal, for this reason, that the railways bring their exports through this point, and if our waterways between Montreal and the seaboard is interfered with in the slightest degree, even by an inch, if you will, it means that the railways, if they cannot find water enough here to float the large steamers they now sail to Montreal, that they must go elsewhere with their exports, take them to Portland, Quebec or some other point, meaning increased haul and increased cost to the producer, and relatively a direct set back to the Canadian waterways. Nor are our Canadian railways the only ones interested. We have the American railways in the Northwest, the Northern Pacific, the Great Northern and other roads centering through Minneapolis, which have their connections with Montreal, just as deeply interested in the waterway east of Montreal as what are our own Canadian railways.

As to the canal system which we hold should not be interfered with even by the slightest degree, we have some 72¼ miles of canals, extending from—not taking in the Sault Ste. Marie—extending from the Welland to the St. Lawrence, for that distance, on which the Government has expended to date some $76,000,000, or $80,000,000. The total tonnage passed through these canals in 1903 represent, through the Welland, over 1,000,000 tons, and through the St. Lawrence canals, over 1,600,000 tons. I mention these figures to show the magnitude of the commerce which is now flowing through these canals, seeking Montreal as an export point.

Not only would our canals be affected by any difference in the level of water, but all the approaches to these canals. all of which have been dredged by the Dominion Governemnt to give us a uniform depth from Lake Erie to the seaboard to 14 feet; and if the level of the water is interfered with by the smallest amount—Mr. Wisner in his report has called it a material amount—and if that material amount may be an inch or two inches or half a foot, it may not appear great, but all our waterways from the Welland canal, to say nothing of our waterway from here down to Quebec would have to be gone over and dredged, would have to be re-constructed, you might say; and it is a matter in which we here in Montreal have a lively interest that our waterways between here and the west should not be interfered with in the slightest degree.

I might be pardoned for referring to what eminent men say with regard to our waterways, but it appears to me you can take what a man who is in position to appreciate the importance of it says, and it may have greater weight. Mr. Thomas Shaughnessy, in reference to the waterways of Canada, has referred to the fact that they ought to be conserved for the interests of Canada. If a railway magnate thinks our waterways of sufficient importance to give them a thought, I think it is our interest to see that those waterways should be conserved for our country.

The channel between here and Quebec, I understand, is dredged sixty-two and a half miles. Unfortunately under the water we do not have an opportunity to see the extent to which the dredging has been done. In the canal, if any person passes through it, the channel under the river is not to be seen. But it is there nevertheless. It is dredged sixty-two and a half miles, and when completed to a depth of thirty feet it will cost some $10,000,000. In addition

to this we have lighting and other expenses incurred upon it. You will see that in addition to any alteration that might take place in the river, in the channel you have in addition, sixty-two and a half miles dredged between here and the seaboard; but that is not all; if you interfere with the level of the channel between here and the seaboard one-half a foot, it means you have to go all over that dredging again, and the next time you go over it, the length of the dredging is increased. What to-day is sixty-two and a half miles, six inches of water might in that course require dredging to the extent of a hundred miles. I want to impress that on you, because six inches looks so slight, because six inches to us is of the greatest magnitude, of the greatest importance. It seems to me if anything should be done in connection with the waterways, it would destroy the utility of this work, requiring it all to be gone over again.

Mr. Wisner, in answering my questions just now, has told us that the extreme variation is about 4.6 feet in Lake Erie. I might quote from his report, in which he says: 'Under the influence of varying relative supply, evaporations and discharge, the monthly mean level of Lake Erie has had an extreme variation of 4.6 feet during the past seven years.'

'The low level generally occurs at a time of the year when navigation is most active, but if the level of the lake could be constantly maintained at or near the high stage, navigation would be greatly benefited by securing a maximum depth at the time when it is most needed and by the practical deepening of the lake harbours.'

If that is the case, that the water is to be held back in Lake Erie during the time it is most needed, during the months of October, November and December, the gates, you will notice he stated, will not be open until after the close of navigation, which he stated would not be until probably the first of December —last year it was later—what is to become of the St. Lawrence?

How is he going to provide for the evaporation or the drainage that occurs from Lake Erie? He is going to hold the water back by a system of gates, and he is going to keep it at a mean depth of about three feet, by the action of this weir; and it seems to us that we too would suffer down here by this action of the commission in holding back any water in Lake Erie, and not giving it to us just when we require it.

It is well known that the low water in this river extends from August, September, October and November, and that is when we want that water, just when we require it for navigation from Lake Erie down to the Seaboard; and Mr. Wisner, in his report would hold it back in Lake Erie and he would not give it to us.

He has stated that the outlet to Lake Erie would be decreased by whatever may be the superficial area of that weir, and in this case, he would hold the water back while we ought to receive it on the St. Lawrence to help us out with our shipping, to give us the depth of water we require.

With regard to the effect on Lake Ontario, it must not be lost sight of the level of Lake Ontario, as far as I can gather from records, is about the same as in Lake Erie, that is, they have high water in Ontario about June or July, and they have low water in Ontario during the same months that they have in Lake Erie, practically up to February. What does Mr. Wisner say with regard to this:

'The modifications of the outflow of Lake Erie proposed for the regulation of its level will not materially change the total volume of annual discharge and will amount to only one-fifth of the variation of the discharge for different years, under present conditions. The effect of this modification upon Lake Ontario will be simply to increase the rate of raise in the Spring and make the date of maximum stage a little earlier.'

But, sir, there are other conditions which have to be considered besides the conditions of navigation on Lake Ontario. He will raise the water earlier in Lake Ontario. Instead of the water being high in Lake Ontario in June or July it will be high probably in the month of May. We want the water later, not in the month of May. There they will have low water in Lake Ontario in November, December and January. He would make that date earlier; if because we have high water earlier, we have low water earlier. We might have low water in December.

It seems to me it is conclusive proof that if you remove from Lake Ontario the supply, it is going to take away from the level used, so when we want it down here we are bound to be the sufferers.

As he further stated in regard to this water supply. the gates on Lake Erie will not be open until the close of navigation. He says in his report: 'A year of maximum supply similar to that of 1876, can only occur after one or more years of excessive rainfall over the entire lake basin, and when such conditions are known to exist, the level of the lake can be allowed to fall sufficiently after the close of navigation each year to provide storage for any excess supply that may be expected.'

He will open those gates and perhaps help us with our floods; will open them in Janaury, February and March to take care of this precipitation and we will be flooded down here in the months of April and March, and when we require the water along in September and October, we won't have it. This is quoting from Mr. Wisner's own report.

He further states in his report, 'that to maintain the level of a lake at or near some fixed stage, the discharge must be controlled so that it will always be approximately equal to the difference between the supply of water to the lake and the evaporation from its surface. In the case of Lake Erie this can only be accomplished by establishing regulating works in or near the discharging waterway. These works must be so arranged that they will not only maintain the level of the lake at or near the fixed stage adopted, but also that they will produce no injurious effects upon the lakes and waterways from which a part of the supply is derived or upon those which receive the discharge.'

The effect is that we will therefore have a limited supply at a time when evaporation is greatest, and at a time when full discharge is required for the St. Lawrence.

He stated that so far as Ontario is concerned, supplementary regulating works could be constructed. He says: 'If it should be found desirable to control the discharge of the St. Lawrence river, within such limits as to reduce the fluctuations from 5.5 on Lake Ontario, under present conditions, to one-half that amount or less, it could be easily and cheaply accomplished by regulating works at the head of the Gallop rapids.'

It seems to me that putting in regulating works at the Gallop Rapids is only so far as we are concerned, making us jump from the frying pan into the fire. It seems to me that the flow of water would be considerably interfered with from the Gallop Rapids down to the seaboard, rather down to Quebec. I don't see how it could be otherwise. You are in a season of the year when you have not got the storage that is required to draw from.

I presume, Mr. Chairman, you will agree with me that when you disturb nature, somebody will have to pay for it. It is a general thing that when you interfere with nature somebody is going to pay for it. It seems to me that if you interfere with the flow from these upper lakes, interfere with their ordinary exits, then you are going to make somebody suffer for it. I might again refer to the report in substantiation of this. And you might almost take the words, 'Lake Superior' in my quotation, and read it, 'Lake Huron', or rather Lake Erie; and where he

will speak of Lake Huron and Lake Michigan, read, St. Lawrence River. He says:

'The storage capacity of Lake Superior amounts to 28,000 cubic feet per second annually for each foot in depth on the Lake surface.'

Why, sir, I presume that this was brought about on account of the works which have been constructed at the exit of Lake Superior and at Sault St. Marie. Certain works had to be created to regulate the water from the lakes so that the artificial waterways on both sides of the line would not take more water from the lake than what would get out through the natural outlet. Such being the case at the mouth of lake Superior why should the outlet at the mouth of Lake Erie be interfered with? It is just as necessary for the St. Lawrence that the outlet of Lake Erie should not be interfered with as that the outlet of the Lake Superior should not be interfered with in the interests of Lakes Huron and Michigan.

He further states in his report—of course, you will excuse me quoting from his report, but that is the only data we have to go by.

'To regulate the level of Lake Erie, so as to maintain its surface near some fixed plane of reference will require such control of the outflow through Niagara river, that the storage which would naturally occur in the lake will be discharged during the first half of the year, and the outflow be diminished a like amount during the last half of the year. This modification of outflow will not materially change the total volume of discharge for any entire year, and will amount to only one-fifth of the variation of discharge of the river for different years under present conditions. The effect of this modification of flow through Niagara river on the level of Lake Ontario will be to slightly increase the rate of rise in the spring and make the date of maximum stage a little earlier.

You will note from this that the discharge will be increased from January to June, and decreased in July up to December. As I have already stated, it is disastrous to Montreal.

Mr. Wisner there speaks of the yearly discharge. Well, sirs, I think we are hardly interested in the yearly discharge, not in the degree in which Mr. Wisner refers to, if I understand the meaning. What we are interested in, and what the Canadian Commissioners have to keep prominently before them is the season of discharge, at different periods of the year.

There might be one-fifth of a difference during this whole year, but we are not interested in the average. What takes place in the winter doesn't interest us, except we don't want to be flooded. It does interest us when we come to the period of navigation, from the first of May until the end of November, and that period must not be interfered with, or else Montreal would be the sufferer.

When Mr. Wisner comes to the St. Lawrence, he stated, as he stated to-day that he has no reliable data as to what would be the extent of the difference on the St. Lawrence. He does say the waterways would not discharge to any material extent.

To individual interests there would be some difference. I only ask the two countries to give it the most serious consideration. So far as we are concerned, we feel absolutely certain it is going to make the greatest difference to our waterways.

Mr. Wisner has been perfectly conscientious in stating what are going to be the benefits, as to the objects of the dam. The object, he stated, is to help out the lake ports, to help the works which are going to be created on the rivers entering Lake Erie, and in his work he gave us some particulars of what these amount to.

The ports of Lake Erie, on the American side, are probably saved, by the elevation of the water, some $3,000,000. The work on the St. Clair river, and the Detroit river, which have got to be deepened by the way to twenty-one feet and widened to six hundred feet, the channel,—he will be able to create

those works, and if I understand his report correctly, it will be a matter of another half million dollars under the cost of what it will cost to construct this weir. In other words, there will be a direct saving of about $3,500,000 by the construction of the weir at the foot of Lake Erie.

I have not, Mr. Chairman, purposely referred to any shipping matters or harbour matters, as these interests will put these different facts before you. But I would like to say this, as I referred to it before, in regard to the importance of the St. Lawrence route to the United States, as last year, while the exports of grain from this port were over 19,000,000 bushels, the American shippers supplied about one-half of it, going to show the importance of this route, not only to Canadians, but to other residents of the United States, who are living in the Northern States. Their products, when it comes to a question of exports, more or less have to be considered by the St. Lawrence route. The St. Lawrence route has to be considered in the question of rates and prices. We regulate this so that almost every resident of the United States, north of a certain line will derive benefit from it. The fact is, you can go as far south as St. Louis and Louisville, and you will find people as far south in that part of the United States deriving a benefit from our waters.

As to the future, you Canadian Commissioners must bear in mind that the future of Canada is great. We Canadians may be excused by the American Commissioners if we are a little boastful as to what are the probabilities of our great Dominion of Canada, but when you take the great prospects before us, the great advantages we have, the great area of territory we have for the production of farm products, to say nothing of the minerals and forests, we say we have a great future before us, the greatest future that any country ever had.

While the United States has been developed during the past hundreds of years, been vastly developed, we, to-day are something like Japan in this respect, we are starting out and are going to derive the benefits of what they have learned. We are going to learn from them everything that they have learned during the past hundred years, and as it has been well said by an eloquent speaker, that twentieth century is a Canadian century. I think that in years to come perhaps we will even open the eyes of our cousins to the south of us in the rapid strides we will make in the development of our country. This must not be lost sight of by the Canadian Commissioners. It is wound around the heart of every Canadian; every Canadian likes to refer to it, to speak of it as something which he is interested in, the advancement of this country and of its prospects.

I have the honour now, Mr. Chairman, to protest and protest as strongly as I can on behalf of the Board of Trade and the Commercial interests of the City of Montreal, to the construction of any works at the outlet of Lake Erie, which will in the least degree, even if it is the fractional part of an inch, interfere with the waterway from the foot of Lake Erie to the ocean. (Applause.)

CHAIRMAN MABEE—Does any other representative desire to speak on behalf of the Board of Trade?

Mr. KENNEDY—On behalf of the Harbour Commissioners, it seems hardly necessary, at this stage of the proceedings to say very much. The scheme as laid was really not connected with the present commission. We cannot assume that this is going to be adopted. All that needs to be said is that we would protest earnestly against anything which would go to lower the St. Lawrence river at this point.

The proposition of Mr. Wisner certainly would have that effect. By putting the lake at a fixed level, as has already been pointed out would send to us a very large quantity of water in the Spring, and it would reduce the quantity of water flowing in that part of the year. And that would have a bad effect on the St. Lawrence; but I think the Harbour Commissioners are so thoroughly confident

in the ability and the watchfulness of the Canadian Section of the Commission, and the good feeling of the American Section of the Commission that nothing of that kind will be done, and until some scheme is laid before us, really it seems to me it is needless to say very much on behalf of the Harbour Commission.

Chairman Mabee—Representative or representatives of La Chambre de Commerce.

Mr. H. A. A. Brault—President Chambre de Commerce—Mr. Chairman and members of the Commission, I think we have to congratulate ourselves on the appointment of this commission, and the good feeling existing between the Commissioners. The task of accomplishing this work will be difficult, I have no doubt, and it will be the privilege of the Commissioners to adjust matters by addressing themselves to justice and equity, and we have no doubt that it will be to the entire satisfaction of the people.

I must congratulate my friend, the president of the Board of Trade for the very eloquent plea he has made, which makes it unnecessary for me, even were I able to do so, to repeat what he has said, and I must thank Mr. Wisner for the very fair answers he has given, and with the permission of the Commissioners I wish to lay before you a few remarks of our Board on the subject:

The following gentlemen convened by Mr. H. A. A. Brault, President, and delegate of the Chambre de Commerce to the International Waterways Commission, viz: M. M. A. V. Roy, C.E.; L. A. Herdt, C.E.; George Janin, C.E. and Jos. Haynes, C.E.—members of said Board, met on the 6th instant.

Mr. Brault advises these gentlemen of the object of this meeting, which is to make the study, at the request of the Canadian Commissioners of the Commission of the International Waterways, of the technical and general aspect of the proposition of erecting a dam on the Niagara river, at the lower end of the Harbour of the City of Buffalo, on Lake Erie, and to express their views on the consequences of the carrying out of the said project.

After a careful study of the few documents and maps concerning the same, placed at the disposal of this Board by the Secretary of the Canadian members of the International Waterways Commission, and, after full discussion, the members of this meeting, representing said Chambre de Commerce, beg to report as follows:

'The construction of a dam at the point before mentioned, may give rise to the following results, which are detrimental to the interests of the persons and parties settled along the river shores, below and above this work.

1st. In disturbing the actual waterflow of the Niagara river and altering the permanency of water level of Lake Ontario, thus affecting the industries situated below, and utilizing this water.

2nd. In seriously endangering navigation in the rivers and Canals specially at the time of low water, which condition could only be remedied by very costly undertakings.

3rd. Interfering with the water supply (city water works and water-power developments) of large cities, which depend upon the present and continuous water flow of the River St. Lawrence.

4th. In exposing the people and parties settled above to periodical floods resulting from the raised level of Lake Erie and by the action of the winds, such danger being possible on account of the higher level of those waters common to the two countries, the actual condition of which must be maintained in their integrity. The data given not being sufficient to permit of a comprehensive technical study of the question, although it enables us to apprehend the dangerous conditions that would result to our country by the carrying out of this project, our Chamber on this account, would strongly advise that the question

be dealt with by the proper authorities with the utmost eare, since our eommeree and industries depend almost entirely on the facilities to be offered by our waterways.'

The President and Delegate.

(Sgd) H. A. A. Brault.

Montreal, 10th July, 1905.

Chairman Mabee—The Shipping Federation of Canada:

Mr. Hugh A. Allan—Mr. Chairman and gentlemen of the Interuational Waterways Commission: In putting before you the views of the Shipping Federation of Canada, regarding the proposal to build a dam at the eastern end of Lake Erie, I should explain that in our estimation this proposition is so full of serious danger to the enormous interests we represent, that we had prepared a few statements. I will present it to you for referenee, but I will not put it before you to-day. I will eonteut myself with giving you a general outline of the position and this with the statements that have been prepared will show you fully what our views are on the subjeet.

1st. Geueral faets about the city aud port of Montreal to be read in detail.

2nd. Improvements in the Ship Channel of the River St. Lawrenee. This subject which is fully covered by statement No. 3, I shall not deal with in detail, but merely remark that the distance from Montreal to Quebec is 160 miles. Of this distance about 65% is natural deep water. From Montreal to Three Rivers, 62 miles, the channel requires deepening.

At present there is a channel from Montreal to Quebec of 27½ feet at low water, with a minimum width of 300 feet. The intention is to dredge a channel between these two ports to give a depth of 30 feet at extreme low water, and a width of 450 feet to 750 feet at the bends.

To enable the navigation of the St. Lawrence between Quebec and Montreal being earried on at night, the Government have gone to an enormous expense in lighting the ehannel with range lights and gas buoys. This, together with the cost of dredging, whieh in itself, considering the volume of traffie using the St. Lawrence route is not exeessive by any meaus, comprise a very considerable sum of mouey and which when completed on the lines at present laid out, will represent, roughly speaking, from ten to twelve million dollars.

Statement No. 3 gives the uumber of vessels and their tonnage eutered and eleared at the ports of Montreal, Sorel and Three Rivers aud the value of the imports and exports for the year 1904. The total number of vessels was 489, and the tonnage, 1,357,816 tons inwards; and outwards, the number was 514 vessels of a tonnage of 1,402,255. The value of the imports and exports earried by these vessels was $149,562,696.

Statement No. 5 shows the number and tonnage of Canadian and United States vessels trading on the rivers and lakes between Canada and the United States, whieh arrived and departed during the fiscal year ending 30th June, 1904. The total number of vessels was 41,626, and their tonnage was 15,375,500 tons.

Statement No. 6 shows the draught of water that a number of vessels had on arrival and sailing from the port of Montreal, from the opening of navigation this year to date. From this, it will be seen that we have been able to despatch steamers from here so far this season at a draught of 28′ 4″, but when I refer to the statement giving the highest and lowest water in the channel since 1890, I find that in one year, 1895, we were down to a depth of 25 feet 10 inehes, and

in several years to a depth of less than 27 feet. From this it will be seen that though we have steamers that we load to 28′ 6″ when we are able to do so, there is, during a considerable period of the season of St. Lawrence navigation, such a shortage of water in the river that we are unable to load our largest steamers to their greatest draught, and are therefore very much handicapped in competition with other routes. Anything therefore, that will take from us an inch of water, represents a considerable number of tons to be deducted from the carrying capacity of our steamers, and our claim that nothing must be done to lower the water in the St. Lawrence is, to say the least, only reasonable when you consider the conditions which we labour under and the handicap that is put upon our shipping.

Speaking for a moment for the Allan Line, the line which I am connected with, I may frankly say that we look forward to having considerable difficulty in loading our largest steamers to their full capacity in the present state of the channel, when the water becomes lower, as it will do as the season advances, and we have already been consulting with the masters of our vessels as to how best to arrange the storage and use the water tanks so as to bring the vessels on their inward voyage as well as on their outward voyage to an even keel, enabling us to use our space to the best advantage.

During the last eight years the Dominion Government, represented by the Minister of Marine and Fisheries, has done so much towards the improvements of the St. Lawrence route, that we, the members of the Shipping Federation, look forward with confidence to a continuation of the work to such a point as will enable us to build steamers for the Canadian trade, of a tonnage equal to the most modern steamers running to New York in competition with us.

As an example of how we are at present handicapped in this direction, I may state that the largest steamers presently running to the St. Lawrence are from ten to twelve thousand tons, not more, while at the port of New York, we have the Cedric, 21,000 tons, and Baltic, 24,000 tons, the Caronia, 20,000 tons, besides many others of about the same size.

When the channel is deepened to a minimum depth of 30 feet at low water, we will be in a position to increase the size of our vessels and will consequently, with the opening up of the country, be able to take a much larger share of trade to and from the Canadian northwest, as well as the Western States. It should also be borne in mind that the distance from Montreal to Liverpool is 2,633 miles via Belle Isle, and 2,773 via Cape Ray, or about 200 miles nearer than the nearest port in the United States. The distance from Montreal to Chicago by the St. Lawrence is 1,261 miles, 158 miles less than from New York, and with the canals of the St. Lawrence, which aggregate only 70 miles, against 350 miles of artificial navigation by the Erie canal from Buffalo to New York, it seems to me we may claim that the St. Lawrence route is to-day the most important waterway on the American continent, and if this is true of to-day, what shall we say of the very near future?

We are growing rapidly; our farm lands are being taken up in a manner that surprises the most sanguine believers in the future of the west, and the result of this, the enormous production of wheat will, in a year or two surprise the whole world and will bring Canada into the first rank as a feeder to Great Britain and other countries in Europe.

I have tried to give you a brief outline of the magnitude of this grand waterway which is our natural heritage, and which we must safeguard from all encroachments at all hazards, I might have said more concerning our canals as feeders to the St. Lawrence route, but their business is well known and has been already explained to you by those who have spoken before me, and I need not therefore detain you with any further arguments as to why we should call upon the Commissioners appointed by the Dominion Government in look-

ing into this matter of the building of a dam in Lake Erie, to use great diligence in conserving to us the supplies of the St. Lawrence river as they now exist and to prevent as far as they can any action being taken that will even, in a very small degree, affect the water supply of the St. Lawrence. It is with us a question of inches, not of feet, and we must not give up an inch lest we should lose an ell.

GENERAL FACTS ABOUT THE CITY AND PORT OF MONTREAL.

Montreal is the chief port of entry of Canada, and is unrivalled by its situation at the confluence of the St. Lawrence and Ottawa rivers at about the point where the St. Lawrence ceases to be navigable for ocean ships.

The river St. Lawrence is 1,500 miles long and drains an area of 330,000 square miles from Montreal to Quebec, a distance of 160 miles; its width varies from one to two miles; from a short distance below Quebec to the Gulf of St. Lawrence it varies from 10 to 35 miles in width.

Half way between Montreal and Quebec the river widens out into Lake St. Peter which is nearly twenty miles long and nine miles wide. The distance from Montreal to the Atlantic Ocean is a little under 1,000 miles. The city is 250 miles above salt water and is 332 miles nearer to Liverpool via Cape Race or 472 miles via Belle Isle, than the city of New York. One-third of the whole distance to Europe by way of St. Lawrence is comparatively in smooth water. Westwardly the distance from Montreal to Chicago by the St. Lawrence is 1,261 miles and 158 miles less than the distance from New York to the same city, while the canals of the St. Lawrence aggregate only 70 miles against 300 miles of artificial navigation by the Erie canal to Buffalo.

RIVER ST. LAWRENCE SHIP CHANNEL.

PHYSICAL FEATURES.

The distance between Montreal and Quebec by the River St. Lawrence ship channel is 160 miles. Of this distance about 65% is natural deep water not requiring any improvement.

From Montreal to Three Rivers, 82 miles, the tide is not appreciable.

From Three Rivers to Batiscan, 20 miles, the tide can always be felt, but owing to uncertainty of time and height, it cannot be depended upon for navigation.

From Batiscan to Portneuf, 22 miles, during six hours out of every twelve, half-tide giving an additional depth of from 1 ½ to 4 feet, may be taken advantage of, by passing during those six hours.

From Portneuf to Quebec, 36 miles, there is a tide of from 9 to 15 feet, giving tidal navigation for about nine hours out of every twelve.

The water in the river has a very great annual fluctuation. The average height above ordinary low water is for May, 6½ feet; June, 4½ feet; July, 5¾ feet; August, 1¾ feet; September, 1 foot; October, 1-3 foot; November, ¾ foot.

The total fall in water level at ordinary low water between Montreal and Quebec is about 29 feet.

From Montreal to Three Rivers, 11 feet; from Three Rivers to Batiscan, 3½ feet; from Batiscan to Portneuf, 10½ feet; and from Portneuf to Quebec, 4 feet.

The current varies throughout. It is strongest at St. Mary's current in Montreal Harbour, at Cap à la Roche and at the Richelieu Rapids. It is quite gentle in Lake St. Peter.

The general average is about 2½ miles per hour.

The River St. Lawrence between Quebec and Montreal is usually free from ice about April 10 and closed to traffic about November 25, making the season of navigation about seven and a half months.

Navigation between Quebec and Montreal is still governed by the depth of water, as found from day to day, in the uncompleted portions of the 30 foot ship channel.

At these places there is still a depth of only 27½ feet at ordinary low water, and a minimum width of 300 feet.

In the distance between Montreal and Quebec of 160 statute miles, the length requiring dredging to give 30 feet depth at extreme low water is about 62½ miles. In all, 42 miles have been completed to 30 feet depth and with the exception of a few miles in the straight reaches of Lake St. Peter, also widened to 450 feet. Except, therefore, in the 20½ miles yet to be dredged, vessels now run free, at full speed and with perfect safety.

In these completed portions of the channel there is a depth of 30 feet at the extreme low water of 1897, giving nearly 4 feet greater draught for navigation than in the present channel.

The improved channel is being widened to a minimum of 450 feet, and at the bends of from 500 to 750 feet.

The completed sections are being marked with permanent range lights and gas buoys for the safety of day navigation, and for facilitating navigation by night for all vessels upward bound, as well as light draught coal ships outward.

The division between Montreal and Sorel Harbour has been completed throughout. A vessel now, of no matter how great a tonnage that can pass Lake St. Peter, may proceed with safety to her berth in Montreal. The very largest ships of the Allan and Dominion Line have this year on several occasions, reached their docks in Montreal after 11 o'clock at night.

It is unfortunate that similiar improvements as have been completed between Sorel and the eastern limit of Montreal Harbour, have not yet been made in the channel opposite Longueuil in Montreal Harbour.

During the season of 1904, the water has been exceptionally high, the lowest stage reached during the season of navigation giving a depth of 28'.1" in the present, or 27½ foot channel.

The average depth of water available for navigation with the greatest and least depths in each year, from May to November, since 1890 is given in the the following table:—

AVERAGE DEPTH FOR EACH MONTH, 27½ FOOT CHANNEL.

From Sorel Gauge during each Year (May to Nov.)

Year.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Highest.	Lowest.
	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.
1890....	35 6	35 3	31 9	30 6	30 9	29 9	30 6	37 0	29 0
1891....	34 6	31 3	29 9	29 9	30 9	28 3	28 3	36 9	27 3
1892....	31 6	31 9	31 6	30 6	28 9	28 3	28 3	33 6	27 3
1893....	31 0	34 3	30 9	29 9	29 6	28 6	28 0	37 6	27 6
1894....	34 6	31 9	31 0	29 2	28 3	28 9	29 0	36 0	27 7
1895....	33 3	31 3	28 3	29 3	27 6	26 9	26 9	34 6	25 10
1896....	33 6	30 6	28 9	28 0	27 6	27 9	29 0	37 0	27 4
1897....	35 6	32 6	30 3	29 3	28 0	27 6	27 0	37 0	26 3
1898....	31 6	30 9	29 8	28 6	28 2	28 3	28 6	32 1	2 ; 9
1899....	36 2	31 9	30 3	28 6	27 6	28 0	27 9	37 9	26 9
1900....	33 6	30 9	30 6	29 6	28 1	28 9	29 2	35 9	27 4
1901....	34 3	31 10	29 2	28 3	27 7	27 4	27 3	36 3	26 6
1902....	33 2	32 2	32 2	29 4	28 1	28 1	29 0	34 1	27 6
1903....	32 0	30 11	30 5	29 5	28 4	29 0	27 11	32 8	26 11
1904....	36 3	34 5	30 9	29 5	29 5	30 4	29 3	37 4	28 1

Before the commencement of any dredging operations, the depth on the flats of Lake St. Peter was about 11 feet at the ordinary autumn low water of that time.

The actual improvements were commenced in 1844 and continued by the government as a public work until 1846 and abandoned the following year owing to the opposition to the location of the channel.

Legislation was passed in 1850 transferring the plant and authorizing the Montreal Harbour Commissioners to borrow money and proceed with the works as they should deem best.

From 1851 to 1888 all operations for the improvement of the St. Lawrence between Montreal and Quebec were carried on by the Montreal Harbour Commissioners, the interest on the cost of the work being defrayed by a tonnage tax on all vessels drawing 10 feet and upwards.

In 1888 the channel from Montreal to Cap à la Roche was completed to 27½ feet at ordinary low water, and from there to Quebec 27½ feet at half-tide.

The government decided in 1888 to re-adopt the River St. Lawrence ship channel as a public work.

Under the Public Works Department, from 1888 until 1898 the work begun by the Harbour Commissioners was continued.

The difficult rock work at Cap à la Roche and Cap Charles was completed as designed.

Almost all of the dredged portions of the river except the channel in Lake St. Peter were cleaned up or deepened, and many curves and narrow places were widened.

Surveys were made, and between Cap Charles and Quebec, to avoid the necessity of waiting for the tide, channels were dredged through several shoals.

The extraordinary low water of 1895 and 1897 and the increase in the size of vessels, urgently called for a wider and deeper channel.

In 1897 it was decided to construct a new plant consisting of large and powerful dredges, tugs, barges, etc., suitable for channel improvement on a large scale.

PRESENT PROJECT.

In 1899 the dredging plant was in a position to warrant the commencement of a more extensive plan of operations, and as two new dredges of a large type, with tugs and plant had proved their efficiency, two powerful steel dredges designed according to the best practice add experience in this identical work, with tugs etc. were completed and two more, to complete the six required, were authorized.

With a proper dredging fleet assured, and the necessary shops and ship yard at Sorel available, the work of the 30 foot channel was undertaken.

The low water of 1897, the lowest on record, except the short period of extraordinary low water of 1895, was adopted as the plane of river level at which the channel would be made 30 feet in depth.

It was also decided to make the channel as wide as could be dredged in one cut, to wit, 450 feet.

The present object of the dredging operations is to obtain in the shortest possible time a ship channel between Montreal and Quebec for safe 30 feet navigation.

The minimum width for the tangents has been fixed at 450 feet, but the bends are widened to from 500 to even 750 feet. The dredging is being done to give a clear depth of 30 feet at the low water of 1897.

The navigable depth in this channel as being dredged, during the season of 1904, was as follows:—

—	May.	June.	July.	Aug.	Sept	Oct.	Nov.
	Ft. In	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.
1904	39 11	38 1	34 5	33 1	33 1	34 0	32 11

The greatest depth from May to November was 41'0"; and the least, at the end of November, 31'9".

The total distance between Montreal and Quebec is 160 miles. The length requiring dredging between Longue Pointe, the eastern limit of Montreal Harbour and Quebec Harbour is about 62½ miles.

COST OF SHIP CHANNEL TO DATE.

TABLE showing the total cost of the dredging and plant, and the quantities dredged up to June 30, 1904.

—	Cost of Dredging.	Exp. for plant, shops, surveys, &c.	Quantities dredged.
	$	$	Cu. Yds.
1851 to 1888—			
Dredging Montreal to Cap à la Roche to 27½ feet at ordinary low water, and from Cap à la Roche to Quebec to 27½ feet at half tide	3,402,494 35	534,809 65	19,865,693
Dredging consisting of widening and cleaning up of channel; deepening Cap a la Roche to Cap Charles to 27½ feet at ordinary low water and dredging at Grondines, Lotbiniere, and Ste Croix, 1889 to June 30, 1899	829,583 08	486,971 79	3,558,733
Present project: dredging channel between Montreal and Quebec to 30 feet at lowest water of 1897, also widening to a minimum width of 450 feet and straightening	100,191 00	265,270 78	1,107,894
Fiscal year 1899-1900	136,680 83	287,040 40	2,479,385
Fiscal year 1900-1901	185,429 80	479,731 47	3,098,350
Fiscal year 1901-1902	255,776 55	277,703 50	6,544,605
Fiscal year 1902-1903	276,958 59	308,765 44	4,619,260
Fiscal year 1903-1904			
	5,187,114 21	2,640,292 67	41,273,920

SESSIONAL PAPER No. 19a

PROGRESS OF THE DREDGING OPERATIONS AT THE DATE OF WRITING, THE CLOSE OF THE SEASON OF 1904.

Locality.	Total Length Requiring Dredging.	Length Dredged in 1904.	Total Length of 30 Foot Channel Dredged.	Length yet to be Dredged.
	Miles.	Miles.	Miles.	Miles.
Division 1—Montreal Harbour to Sorel...	21.80	...	21.80	...
Division 2—Sorel to Batiscan.....	12.45	3.10	8.00	4.45
Division 3—Lake St. Peter.. . .	18.00	1.80	(7.70) (3.60)	6.70
Division 4—Batiscan to Quebec...	10.00	...	0.90	9.10
	62.25	4.90	42.00	20.25

From Batiscan to Quebec the tide is available and by taking advantage of it, vessels of heavier draught may pass.

During the summer of 1903, the practical completion of Division 1 was announced. This gives a channel between Sorel anchorage and Longue Pointe, the eastern limit of Montreal Harbour, of a depth of 30 feet, at the extreme low water level reached in 1897, and having a minimum width of 450 feet.

In the forty miles of navigation between these two points there are now sixteen tangents, joined by easy curves where the channel is widened to from 500 to 750 feet.

In the month of October, 1903, the dredging in Division 1, having been practically completed, and the work thoroughly tested, it remained for the Department of Marine and Fisheries to give the necessary aids to navigation so as to make the improved highway fully available.

In anticipation, this department had early in the season reported on the position and character of the lighthouses that would be required to permanently mark the channel as soon as completed.

On November 1, the lighthouses were put in operation and gas buoys were placed to mark the bends and narrow places.

The benefit to navigation was immediately apparent. In the month of November, when time was of great value, several large ships, instead of anchoring at Sorel, took advantage of the improved and well marked channel and proceeded to Montreal safely making their docks before midnight.

It is not expected that the large transatlantic ships outward bound will sail from Montreal during the night. The time for sailing for these large vessels is usually fixed in advance. Coal ships, however, and other vessels of light draught will be able to sail from Montreal in clear weather at any time when they are ready. Inward boun ships will be able to avail themselves of the improvements throughout the channel as soon as completed.

The utility of the work done on the river St. Lawrence is evident. Advantage of every improvement is immediately taken, and at present time several large ships are being built with a view to the expected increased accommodation.

ESTIMATE 30 FOOT CHANNEL, DEC. 1904, MONTREAL HARBOUR TO QUEBEC.

Locality.	Length of Dredging	
	Required.	Done.
	Miles.	Miles.
Division 1—		
Longue Pointe to Pointe aux Trembles (en haut)		5.05
Ile Ste. Thérèse		0.40
Varennes to Cap St. Michel		3.00
Cap St. Michel to Verchères		4.50
Verchères Traverse		1.10
Verchères to Contrecoeur		1.70
Contrecoeur Channel		6.05
Total		21.80

Statement of Number of Vessels and regular tonnage entered and cleared at the ports of Montreal, Sorel and Three Rivers, for the year 1904. (From the Customs Dept. returns.)

ENTERED.

Ports.	British.	Reg. Tons.	Foreign.	Reg. Tons.	No.	Total Tonnage.
Montreal	387	1,240,510	43	70,838	429	1,311,348
Sorel	3	4,575	44	4,454	47	9,029
Three Rivers	11	35,355	2	2,084	13	37,439
Total	401	1,280,440	88	77,376	489	1,357,816

Total of sea going vessels entered from all ports in the Dominion, 8,143,856 tons.

CLEARED.

Ports.	British.	Reg. Tons.	Foreign.	Reg. Tons.	No.	Total Tonnage.
Montreal	409	1,273,919	38	66,771	447	1,340,690
Sorel	3	4,575	40	5,258	43	99,833
Three Rivers	14	35,392	10	16,340	24	51,732
Total	426	1,313,886	88	88,369	514	1,402,255

Total of sea going vessels cleared from all ports in the Dominion, 7,682,849 tons.

FISCAL YEAR, 1904.

	Value of Exports.	Value of Imports.
Montreal	$67,844,729	$80,561,275
Sorel	41,705	183,740
Three Rivers	479,095	452,152
Total	$68,365,529	$81,197,167
Grand Total	$149,562,696	

Statement showing the Description, Number and Tonnage of Canadian and United States Vessels trading on the Rivers and Lakes between Canada and the United States (exclusive of Ferriage), which arrived and departed during the Fiscal year ended June 30, 1904

	Canadian.		United States.		Total.	
	Number of Vessels.	Tons Register.	Number of Vessels.	Tons Register.	Number of Vessels.	Tons R gister.
Arrived	10,371	4,494,324	10,739	3,628,515	21,110	8,122,839
Departed	9,518	3,481,163	10,998	3,771,498	20,516	7.252,661

Statement Showing the Greatest Draught of Water that a Number of Vessels had on Arrival and Sailing from the port of Montreal from opening of present season of navigation to July 7, 1905.

ARRIVAL.

Name of Vessel.	Dates.	Draught on Arrival. Ft.	In.
Dominion (Collier)	May 4th	24	6
Virginian (Leyland)	" 6th	25	6
Victorian (Allan)	" 8th	26	3
Vancouver	" 11th	25	6
Manxman	" 18th	25	6
Athenia	" 18th	22	5
Virginian (Allan)	" 20th	27	8
Lakonia	" 25th	19	6
Catalone	June 1st	24	6
Ottawa	" 10th	26	6
Virginian (Allan)	" 16th	28	0
Southwark	July 2nd	23	11
Athenia	June 28th	23	5

STATEMENT Showing the Greatest Draught of Water that a Number of Vessels had on Arrival and Sailing from the port of Montreal, &c.—*Concluded.*

DEPARTURE.

Name of Vessel.	Dates.	Draught on Arrival.
		Ft. In.
Ionian	May 4th	24 11
Victorian	" 11th	28 3
Lake Champlain	" 13th	25 0
Tritonia	" 13th	23 0
Marina	" 17th	24 0
Bellona	" 20th	23 0
Kensington	" 22nd	25 0
Athenia	" 23rd	24 6
Virginian (Allan)	" 23rd	28 0
Manxman	" 26th	25 0
Milwaukee	" 27th	25 0
Lakonia	" 31st	24 6
Mount Royal	June 7th	25 0
Kildona	" 9th	24 6
Tampican	" 10th	25 0
Bavarian	" 15th	26 1
Victorian (Allan)	" 22nd	23 4
Cervona	" 30th	24 6
Lake Manitoba	July 5th	25 0
Athenia	" 5th	23 6

Transatlantic passengers carried west bound and east bound to Europe via St. Lawrence Route, by three of the principal lines.

Allan Line	45,582
Dominion Line	20,529
C. P. R. Atlantic Line	17,222
	83,333

Inland Navigation 10,027 vessels entered at the Port of Montreal with a total tonnage of 2,348,496.

Total quantity of coal brought to Montreal via St. Lawrence for 1904,—1,401,611 tons

Dates of Arrival and Departure of first vessels at the Port of Montreal for ten years, viz.: from 1895 to 1904.

Year.	Arrival.	Departure.
1895	April 27	Nov. 25
1896	" 28	" 23
1897	" 30	" 24
1898	" 26	" 28
1899	" 27	" 29
1900	" 26	Dec. 3
1901	" 25	Nov. 25
1902	" 7	Dec. 4
1903	" 26	Nov. 27
1904	May 2	" 27

SESSIONAL PAPER No. 19a

Statement of number of vessels and registered tonnage employed in the coasting trade and Arrival and Departure from Montreal, Three Rivers and Sorel for year ending 30th June, 1904.

	Arrival.		Departure.	
	Number of Vessels.	Tons Register.	Number of Vessels.	Tons Register.
Montreal	3,070	1,743,488	3,612	1,687,828
Three Rivers	526	797,702	521	792,102
Sorel	846	1,217,604	843	1,206,489
	5,042	3,758,794	4,976	3,686,419

From Annual Statement of Trade and Navigation, 1904.

Statement showing that during the thirty years ending 1900, the rate of increased size of ships of 3,000 tons and upwards belonging to Great Britain have increased much more rapidly than ships below 3,000 tons. These returns also show that the collective tonnage of steamships has increased in a very much greater proportion than has their number. The tonnage is not registered tonnage.

Table showing the number and tonnage of steam vessels, registered under the Merchant Shipping Act, belonging to the United Kingdom, classified according to their tonnage, that were employed some time during the year in each of the undermentioned years:

	Number of Steam Vessels.				
	1860.	1870.	1880.	1890.	1900.
Under 500 tons	714	1,472	1,710	2,254	3,525
Above 500 under 1,000	113	495	1,119	1,268	820
" 1,000 " 2,000	92	240	815	1,898	1,718
" 2,000 " 3,000	4	28	131	370	909
" 3,000 " 5,000		1	10	51	332
" 5,000 " 10,000				2	50
10,000 tons and upwards	1	1			
Total	929	2,237	3,785	5,843	7,434

	Tonnage of Steam Vessels.				
	1860.	1870.	1880.	1890.	1900.
Under 500 tons	176,002	283,146	339,217	363,849	400,955
Above 500; under 1,000	35,197	343,033	827,699	961,315	604,340
" 1,000 " 2,000	116,428	332,564	1,055,747	2,033,674	2,696,704
" 2,000 " 3,000	8,524	64,394	308,633	880,759	2,167,424
" 3,000 " 5,000		3,380	32,551	170,292	1,209,940
" 5,000 " 10,000				11,320	321,370
10,000 tons and upwards	13,343	13,343			
Total	399,494	1,039,860	2,593,847	5,021,209	7,400,733

This shows that to meet the requirements of modern commerce, deeper channels are required and ports that do not give facilities for accommodating the larger and modern vessels must be left behind in the struggle for trade.

STATEMENT showing gross tonnage, length, breadth and depth of four of the largest vessels engaged in the St. Lawrence and New York Transatlantic Trade.

ST. LAWRENCE.

Name of Vessel.	Line.	Gross Ton	Length	Breadth.	Depth.	When Built.
Victorian	Allan	10,629	520	60	38	1904
Virginian	Allan	10,754	520	60	38	1904
Bavarian	Allan	10,387	501·1	59·3	39·8	1899
Athenia	Donaldson	7,150	478	56	32	1904
NEW YORK.						
Cedric	White Star	21,035	680·9	75·3	44·1	1902
Baltic	White Star	24,000	708·3	75	49	1903
Caronia	Cunard	20,000	650	72	40	1904
Kaiser Wilhelm II	N.G.L.	19,360	684·3	72·3	40·2	1902

CANALS.

The total expenditure charged to capital account on the original constructions and the enlargement of the several canals of the Dominion, up to June 30, 1904, was $87,223,164.67. A further sum of $21,090,389.93 has been expended from the consolidated fund, including the repairs, renewals, maintenances and operation of these works, making a total of $108,313,554.60. The total revenue derived, including tolls, and rentals of lands and water-powers, amounted to $13,320,222.95.

The total traffic through the several canals of the Dominion for the season of 1903 amounted to 9,203,917 tons, an increase of 1,690,620 tons compared with the previous year. This includes 5,511,868 tons passing through the Sault Ste. Marie canals against 4,729,268 tons in 1902.

On the Welland canal 1,002,919 tons of freight were moved, an increase of 347,532 tons, of which 543,993 tons were agricultural products, an increase of 188,121 tons, and 158,721 tons produce of the forest; of coal, 147,884 tons were carried; 732,829 tons passed eastward; and 270,000 tons westward; 979,817 tons were through freight, of which 715,595 tons passed eastward.

Of the through freight Canadian vessels carried 400,491 tons, an increase of 73,384 tons, over the previous year.

The quantity of grain passed down the Welland and St. Lawrence Canals to Montreal was 351,936 tons, an increase of 143,721 tons compared with the previous year. Of this 40,641 tons were transhipped at Ogdensburg as against 34,060 tons transhipped in 1902. The further quantity of 48,131 tons of grain passed down the St. Lawrence canals, only, to Montreal, making the total 400,067 tons.

On the St. Lawrence canals 1,681,206 tons of freight were moved, and increase of 588,073 of which 756,379 were eastbound through freight, and 211,438

tons westbound through freight; 801,544 tons were agricultural products, 523,564 tons merchandise, 415,642 tons coal and 191,813 tons forest product.

Seventy-four cargoes of grain, aggregating 99,582 tons were taken down direct to Montreal through the Welland and St. Lawrence canals in 1903, twenty-two cargoes, aggregating 17,303 tons in 1901, and fifteen cargoes, aggregating 7,924 tons in 1900.

The eastbound traffic aggregated 26,932,238 tons, of which 3,210,674 tons went to Lake Michigan, 1,155,377 to Lake Huron, 22,212,177 to Lake Erie, and 354,010 to Lake Ontario ports; 955,452 tons were carried in Canadian vessels from Canadian to Canadian ports, 263,748 tons in Canadian vessels from American to Canadian ports.

The westbound traffic aggregated 34,674,437 tons of which 90,031 tons went from Lake Michigan, 226,047 tons from Lake Huron, 7,329,727 tons from Lake Erie and 96,394 tons from Lake Ontario ports; 206,535 tons were carried in Canadian vessels from Canadian to Canadian ports, 259,232 tons in Canadian vessels from Canadian to American ports, and 35,829 in Canadian vessels from American to Canadian ports.

The quantity of grain carried to tidewater on the New York State canals was 327,840 tons, an increase of 9,163 tons, while the quantity carried by the railways of the State to tidewater amounted to 3,793,973 tons, a decrease of 764,563.

The improvement works being carried on at Port Colborne, the Lake Erie entrance of the Welland canal, comprise the deepening of the approach to the canal to 22 feet, and the construction of two docks, with piers, 200 feet wide, upon which grain elevators will be erected for the transference of grain into vessels adapted to the canal navigation when required. In addition to the work undertaken by the government, a breakwater, about a mile in length has been, and another is being constructed across the entrance to the harbour by the Department of Public Works, which will also dredge out the area so contained; thus greatly increasing the accommodation, and insuring safety at this important point. The removal of the centre pier bridges on the canal, which obstructed navigation, is in progress, and new bridges spanning the entire channel are being erected. The deepening of portions of the canal prism is being carried on satisfactorily.

COMPARATIVE STATEMENT of number of vessels arrived at the port of Montreal, with aggregate tonnage for the years 1893 and 1901.

Year.	Number of Vessels.	Tonnage.
1893	804	1,151,117
1901	742	1,453,048

Showing that vessels have decreased in number but increased in size.

CHAIRMAN MABEE—The Chief Engineer of the Department of Marine, I believe, is here.

Col. ANDERSON—(Chief Engineer Marine Department) Mr. Chairman and Gentlemen: I have been called here without any brief, to speak for any party or any side, and I only anticipated that I would be here to answer questions in case they were asked.

At the same time it might possibly be of interest to the American members of the commission to have described in a few words some of the intricacies

with which the government of our waterways are fraught. We have the same interests from the Pacific to the Atlantic to guard, and the improvement of waterways over that stretch is divided up between different government departments, different commissions that are not connected with the Government. For instance, all the canal strips are under the control of the Department of Railways and Canals. In their Annual Report you will find a statement of expenditure made upon that branch of the service. Harbours generally, and the drainage and channels, generally, had been under the control of the Department of Public Works. One of the members of your commission has been resident engineer in charge of one of our most important works, the channel improvement of Port Colborne on Lake Erie.

Last year the Department of Marine took over from the Public Works Department, the improvement of that channel from Montreal to Quebec, because it was found to be so intimately connected with improvements and aids to navigation, it seemed practicable that the whole improvement should be carried out under one administration; therefore it was handed over to the Marine Department.

The Marine Department has, since confederation had charge of all navigation, lights, buoys, fog alarms and things of that kind.

I might say that during the past ten years the policy of instituting aids to navigation has been greatly enlarged, and a more progressive policy has been established, which has been made possible by the greatly increased revenue of the country. Our ambition to-day is to so light the St. Lawrence river that it will be possible to get deep draught vessels up during the night as well as in the daytime, and that, I think, we are in a fair way of realizing in a year or two.

The different harbours on the St. Lawrence river are under the charge of the Commissioners. I might say that the large docks at Quebec were built by the Harbour Commissioners, and I have in my hand a statement of each year since 1890 of expenditures made for the improvement of navigation on the St. Lawrence east of Lake Erie, which I will submit for your use, showing that since 1890 in the Quebec Harbour, $339,000 odd dollars have been spent on Harbour improvements. It does not include the original cost of the docks.

In Three Rivers, $115,150.98.

In Sorel, $272,323.47.

At Boucherville, $2,237.95.

In Montreal Harbour, $712,641.18, and a great many minor works since then.

Then on the ship channel between Montreal and Quebec since 1890, $3,880,346.69 have been spent.

This does not include, by any means the whole expenditure, because the expenditure runs up I think to something like $7,000,000, but the remainder of it was spent before that time.

With regard to the question of the dam at the outlet of Lake Erie, engineers will appreciate the fact that an engineer will not commit himself to an opinion on that until a concrete proposition has been put before him.

There is a great deal to be said on both sides of the question, and one point, I think, that has been lost sight of by the commercial men is the fact that once a level to be obtained by a dam has been reached, that the overflow from the dam will be exactly the normal overflow through the River Niagara if no dam were there at all. That is a point I think that has been overlooked but until a concrete proposition for a dam has been put before an engineer, he certainly cannot venture any opinion as to what the effect will be.

Are there any questions you would like to ask? I would be very glad to answer them if there are.

May I also impress on the commission before sitting down, that my minister recognizes that the importance of the St. Lawrence to the future of Canada is paramount, that no matter what improvements are made by the Dominion of Canada in other portions of the Dominion, that that is our natural outlet to the sea and to the European markets, and that it must be protected so far as the Dominion Government can protect it.

I will submit this statement to the commission for their own use:

STATEMENT OF EXPENDITURE MADE FOR THE IMPROVEMENT OF NAVIGATION ON THE ST. LAWRENCE RIVER, EAST OF LAKE ERIE BETWEEN THE YEARS 1890 AND 1904.

Quebec Harbour.		
1890	$ 248,400.00	
1895	4,115.36	
1903	18,831.65	
1904	68,347.33	
		$329,694.34
Three Rivers Harbour.		
1890	$ 4,145 51	
1891	7,834 28	
1892	362 72	
1897	538 45	
1902	3,176 78	
1903	49,914 21	
1904	49,179 03	
		115,150 98
Sorel Harbour.		
1890 to 1894		272,323 47
Ship Channel Montreal to Quebec.		
1890 to 1900	$ 1,691,181 28	
1901 to 1903	1,603,441 38	
1904	585,724 03	
		3,880,346 69
Boucherville.		
1890 to 1899		2,237·95
Montreal Harbour.		
1900	$ 1,196 61	
1901	49,296 45	
1902	201,722 69	
1903	251,320 47	
1904	209,104 96	
		$712,641 18

In addition to the above noted works, there were minor improvements made along the St. Lawrence east and west of Montreal, by the construction of small wharfs, for the accommodation of local traffic principally dredging at such points as Cornwall, Prescott, Valleyfield and Coteau Landing, etc., which, since 1890 would probably amount to about $200,000; the expenditure at Coteau alone being, between 1890 and 1904, $46,000.

Expenditures were made by the Department of Railways and Canals:— at page 9 part 2 of their report will be found the amount of expenditure made on RIVER REACHES AND CHANNELS. On page 10 and 11 the expenditure on Lake St. Louis and St. Francis.

CHAIRMAN MABEE—The representative of the Dominion Marine Association.

Mr. JAMES CUTTLE—(Dominion Marine Association).

Mr. Chairman and members of the Commission:

The Dominion Marine Association is a Corporation or rather an Association formed to look after the best interests of all the inland waters of Canada.

I might say that we have not got together any data or solicited any information in this case, but simply enter one protest that nothing shall be done to lower the level of the water on Lake Ontario or the St. Lawrence river.

Mr. Gear felt that any increase of the depth of water on Lake Erie would prove altogether a benefit to the American vessels. Now, that is not quite the case, Mr. Chairman. There are quite a number of Canadian vessels built now that are too large to come through the Welland canal. They would benefit by any increased depth of water on Lake Erie, if that increase could be got without depreciating any on Lake Ontario, or the River St. Lawrence, which would benefit Canada to some extent, and we hope in the near future, greatly; but the Association wishes to protest that nothing will be done to lower the level east of the Welland canal.

I have a short memorial drawn up by the Secretary of the Association, which I will read and leave with your Secretary:

TO THE MEMBERS OF THE INTERNATIONAL WATERWAYS COMMISSION.

The Memorial of the Dominion Marine Association Humbly showeth:

That you memorialists include in their membership roll the leading vessel interests of the inland waters of Canada, and represent most of the tonnage interested in the navigation of the Lakes and Upper St. Lawrence, over 112,000 net registered tons of vessel property being enrolled.

'That your memorialists have considered the proposal to erect a dam at the lower end of Lake Erie, and that having regard to the fact that the St. Lawrence route is the natural passage from the Great Lakes to the sea, and is now used by a large and constantly increasing number of vessels, many of them of full canal size and heavy tonnage; and having regard also to the narrow margin of safety in the navigation of certain parts of the harbours, channels and canals on this route and the necessity for maintaining the levels at least at their present standard in order to accommodate the present traffic; and in particular having regard to the fact that a channel of only fourteen feet of water is provided in the Upper St. Lawrence, and that this depth has only been attained at the expense of much time and labour, and large sums of money. Your memorialists believe that any lowering of the water in this route would not only be exceedingly detrimental to the trade interests directly involved, but would also sacrifice the rights of the much larger number who enjoy indirectly as well as directly the benefits of this great water highway; and your memorialists would therefore respectfully present a most emphatic protest against any action which could possibly in any way endanger or interfere with the maintenance of the present levels in the waterway between Niagara and the sea.

Your memorialists understood that it is the intention of your honourable body to obtain full and satisfactory expert evidence regarding the effect of the

proposed dam upon the waterways below it, and your memorialists urgent desire is that if such evidence casts doubt upon the maintenance of the levels in question, the proposed work should be reported against and condemned as improper.

And as in duty bound your memorialists will ever pray

Signed on behalf of the Association, this 8th day of July, 1905.

(Sgd.) J. A. Cuttle,
President.
Francis King,
Secretary.
The Dominion Marine Association.

Chairman Mabee—Mr. Grier and Mr. Macrae are here, representing the Niagara Power Company, interested in this discussion.

Mr. A. Monroe Grier—Mr. Chairman and gentlemen of the International Waterways Commission:

The words I will have to say are very few. I should like, if I may say, sir, fitly, to preface my word or two by saying that you have in the constitution of your commission, and we have had this morning, in the occurrences of the morning, a most charming, instance of the courtesy which exists between the two nations.

I have now to thank the city of Montreal for its courtesy and I think it is very nice of it to permit us, from Niagara Falls, to come before you this morning.

I bear this in mind however, sir, that in a sense we live on the banks of the same river, because to my mind, that river which I see pictured out there, and the one up there is one and the same, so if you call this the St. Lawrence and that the Niagara I shall be unconcerned. I feel we live on the same river.

I have the honour to represent the different Power Companies at Niagara Falls. Before you now are Mr. James Wilson, who is the superintendent of the Queen Victoria Niagara Falls Park Commission, which park is a Government park at Niagara Falls. We, so to speak are tenants of the Government, and Mr. Wilson is the superintendent of the Park. Mr. Macrae represents the Electrical Development Company of Ontario, and I have the honour to represent the Canadian Power Company.

We do not wish this morning to lay before the Board any views with reference to the matter in hand. Our object is to have this Board determine upon a meeting in or near Niagara Falls. Let me say this however. While the interests represented by my friends and myself are of very great importance indeed, I want to speak for my company as well as the others, but if I speak for my company alone, I might be pardoned for enlarging on the point.

With us it is not so much a matter of season as has been referred to in the city of Montreal, as it is perhaps a matter of the direction of the wind; but in whatever light you regard it, I should like it to be borne in mind that we have to do with a river which is liable to be affected in the most extraordinary degree by variation in winds. I do not wish to go into the matter at all fully at this moment. I want, however, to emphasize the fact that we are abundantly concerned in the integrity of the level of the river throughout all seasons of the year.

That being so, it seems to us that the Commissioners should meet in or near Niagara Falls, because there they would have an opportunity of finding out the conditions that prevail. I think also this might be said with regard to the Falls as a meeting place, that we are in a sense in mid stream. There are those that

have their interests above the outlet from Erie; there are you here who have your interests at this end of the St. Lawrence river, so it appears to me to be a place where equitable thoughts are likely to arise and finally, nice judgment will be given. But in addition, bear this in mind, that the interests of Niagara Falls are international. You will get the views on both sides of the river. I think that the other companies are equally concerned with ourselves in the preservation of the level; so if you find it in your power to come there, you will, I think, have an excellent opportunity to add to the already abundant store of wisdom in the possession of the Commissioners.

I should like to say this with regard to the river there, and I admit that the stretch of the river you see in that picture is not good for boating. You must bear this in mind, that when you have gone up stream from Chippawa there is quite a long stretch of river, which at some day, might perhaps hold fleets of vessels, so when you come to consider that stretch of river, it will not only be with regard to electricity, but also with reference to the possible navigation which may be had in the upper approaches of it.

I desire to say then, sir, that we hope very sincerely that the commission will find it within its power to hold a meeting in Niagara Falls, and that the different power companies and the park commissioners will be duly advised, because I feel—I am sure I speak not only for myself here, but for the others with me,—we feel, in the hands of this commission we are absolutely safe.

As an onlooker to-day I could not help thinking of the very charming discussions which went on, and gentlemen, it was rather the confiding statements of one to another rather than a discussion between representatives of different interests.

You have dealt with water to-day and you will also deal with water when you come to Niagara Falls. You will also deal with electricity. We ask you to come to Niagara Falls and consider water transmuted, I might say, through the benificent agency of electricity.

Mr. H. H. Macrae, Electrical Development Co. of Ontario.

Mr. Chairman and Gentlemen:

On behalf of the Niagara Power Company, in connection with the other companies, I only wish to join in the request of Mr. Grier, asking that we have a hearing at Niagara Falls.

Mr. James Wilson: (Queen Victoria Niagara Falls Park).

Mr. Chairman and Gentlemen:

As a representative of the Commissioners of Queen Victoria and Niagara Falls Park, who owns the shore of the river on the Canadian side, all the way practically down to Lake Ontario, I simply join in the request that has been made by Mr. Grier, and under instructions of our Chairman and from the Government of Ontario I am requested to ask the Commissioners to grant a hearing at Niagara Falls, and investigate the effect of a dam on the water levels at Lake Erie or through the course of the Niagara river down to Niagara Falls.

The Commissioners have very grave fears that a dam, while under ordinary circumstances, might not prejudice the water levels, still at certain times of the year, particularly at certain stages of the wind, when the wind is blowing from the northeast, that it would have a very detrimental effect, and that those who have licenses under the Commissioners for the use of the waters for the generation of electricity would suffer very severely; and I am requested to ask that the commission would be good enough to grant a hearing at Niagara Falls, or in that vicinity, at which it would be convenient, after a time was given for the preparation of such arguments as the Commissioners desired to present before this commission.

Chairman Mabee—I might say to the gentlemen who are representing those Power companies, and also to Mr. Wilson, representing the Commissioners

of the Niagara Falls Park, that I have the authority of my brother commissioners to say that we will be very pleased indeed to have a meeting at Niagara Falls, of which we will give all the different interests in that vicinity ample notice.

Mr. Smith (Richelieu & Ontario Navigation Co.)—Mr. Chairman and gentlemen: I have received your invitation on behalf of the Richelieu Navigation Company, to appear before your meeting. In thinking it over, our company decided, as we were members of the Dominion Marine Association, it would be better to allow that body to treat that question as a whole, as they virtually represent what might be called the entire tonnage from Niagara to the port of Montreal.

Mr. Cuttle, the president of that association, has handed the secretary of this commission a memorial of the association. I think, however, that it would be well if in addition to that, he would hand the secretary of your commission the names of the steamboat lines, members of that association; my idea being, that it being a subject common to us all, that if there is any question debatable later on, that it would save time if we would come to a decision, that is, of our association, and present our views as a whole rather than individually, I think it will save time for us and save time for you, and it is the proper way to deal with the subject.

Chairman Mabee—I beg to introduce to the gentlemen assembled, Col. Ernst, chairman of the American Section:

Col. O. H. Ernst—Mr. Chairman and Gentlemen: It is with a good deal of surprise and some chagrin that I find afloat here the idea that American engineers are favouring some plan of work at the outlet of Lake Erie of which one effect will be to injure the St. Lawrence river. The idea appears to have found lodgment in the minds of some of those present. I wish, if possible, to remove it, for nothing could be further from the truth. We have no plan. We have only an idea. It is that something can be done at the outlet of Lake Erie which will be a mutual benefit to both nations. It is not a new idea; it is an old one. It would not have lived one day if it carried with it the notion that it would bring injury to the River St. Lawrence.

The River St. Lawrence belongs not only to you; it belongs to us; it belongs to the world. It belongs to mankind.

Some years ago, in the growth of this idea to which I have referred, a board of engineers did make a report, which has been greatly enlarged upon here this morning. That report is an academic study. It has never been endorsed by the American Government. It has never had the endorsement of any great body of American engineers. It is an academic study pure and simple. With some of its ideas I myself don't agree, although it is a very able and very valuable report, a report of permanent value. I am sure I voice the opinion of my colleagues of the American as well as the Canadian Section of this commission, that to do anything in Lake Erie which will injure the St. Lawrence would be a crime against mankind. It would be a crime to which I for one will never make myself accessory. (Applause.)

If I should aid and abet it in any way, I should never draw an easy breath during the rest of my life. It would be a nightmare from which I could not recover. You need have no fear. (Applause).

Chairman Mabee—Are there any other gentlemen who would like to add to the discussion?

Mr. Arthur St. Laurent (Public Works Department)—Mr. Chairman and Gentlemen: The chief engineer of the Department of Public Works had expected to attend this meeting, but was unable to do so. I have been asked to attend this meeting, which concerns the construction of public works. I have been asked by the department to be present at this meeting and I can assure you that the Department of Public Works is alive to the interests of the country, and will follow the discussions of this body very closely.

As far as I am concerned, my feeling is that after having thoroughly studied the question and after having got at all the facts and data in connection with the problem of the regulating works proposed, if the United States Commissioners find that there is positive proof that it is going to affect our waterways or lower them, that they will be the first, even if there is a doubt about it—that they will be the first to say, 'It is all right; this ends the proposition; we will have nothing more to do with it.'

CHAIRMAN MABEE—I presume, perhaps, we have arrived at the end of the morning discussion, and I have no doubt that the members of this commission, one and all, have derived the very greatest information at the hands of these various commercial bodies appearing before the meeting here this morning.

On behalf of the commission, I beg to thank all those various bodies and interests for the accumulated information that they have given us.

There are tabulated statistics that have been handed in to the Board, and to which we will give the most earnest consideration when the time comes. It is quite evident that a very great amount of labour and investigation has devolved upon some one to prepare this varied information. It will all be, I assure you, of the very greatest use in connection with the studies we must give these matters before arriving at any attempted solution of it.

The members of this Board had an idea of the tremendous commercial interests that were centering in this city. That was a matter of common knowledge to the Canadian members of the Board, and to the gentlemen who represent the United States Government in connection with this inquiry, it was not entirely an unknown matter to them either. Almost every intelligent person throughout the Dominion of Canada as well as throughout the United States knows the extremely advantageous position the city of Montreal holds with reference to the transatlantic trade. Everybody knows how rapidly that important position is improving. I shall follow the example of the President of the Board of Trade and not attempt to deal with the future, because like him, I am apt to let my imagination almost overpower me when I commence to think even of the great possibilities of this great country of ours.

Like my friend, the chairman of the American Section of this commission, I was a little surprised at some of the ideas that have been expressed this morning, that there was any intention of doing anything that would in any way militate against the lake or river trade of this city.

The idea, I fancy, originally grew from certain lake interests. Well, I, for one, and I think I would be endorsed by the business men of the city of Montreal, would be quite willing to lend assistance, any reasonable assistance to the upper lake interests in improving their navigation, if it could be done without in any way injuring the down stream interests. Whether that redounds to the greater benefit of the United States or the greater benefit of the Canadian shipping on the lakes would be a matter of small importance to me.

I think we nations living here side by side must conduct our national affairs upon friendly lines and in a neighbourly spirit, and if we could accede to the request of those interested in maintaining the lake levels of the upper lakes without interfering with the navigation along our long series of Canals of the Upper River St. Lawrence, I would be pleased, as I have said, to lend my assistance in that direction.

But when we reflect on the immense sums that have been expended by the Dominion Government in the long series of canals above Montreal; when we reflect that during the last fifty years, in the neighbourhood of $50,000,000 has been expended in deepening and enlarging the channels below this city; when we reflect upon the tremendous commercial and shipping interests which are centered here, I think it goes without saying, that the shippers and commercial men of Montreal are willing to trust their interests with this commission and

firmly believe that nothing will be done by the Canadian members of the Commission, and I believe nothing is desired to be done by the American members of the commission which will have the slightest effect upon your interests commercially.

The questions involved are large. As I told the meeting in opening this morning, there is no defined plan before the commission. Incidentally the report of Mr. Wisner has been discussed. It is quite proper and fitting it should be discussed. I am glad it has been discussed, a discussion which greatly aids the members of the commission in dealing with the desirability of constructing such a work or indeed any work; and I can only close by again thanking the various gentlemen who have bestowed the labour upon those addresses, reports and memorials that we have had this morning necessarily required, and I say that the reference that these members will make to these in the future will be of very great assistance in determining the questions that it is expected that this commission will ultimately solve or attempt to solve.

Of course no work can be undertaken without the sanction of both Governments. No work of this sort can be completed other than by a treaty between Great Britain and the United States. The construction of any such work as that we have discussed this morning, or indeed any work whatever, involving the results that it is suggested or desired would mean the construction of a work upon Canadian territory. So that anybody who wishes this work completed or indeed who wishes such a work or any similar work reported upon, must satisfy the members of the Canadian Commission that it will in no way affect the interests below Lake Erie or upon Lake Ontario, and the canals and the river, and I for one, and I think my brothers upon the Canadian section will endorse what I say, would never consent to join in a recommendation for any work that will have the slightest prejudicial effect upon the navigation below Lake Erie.

I presume, gentlemen, that will conclude the business of the meeting, and I declare the meeting adjourned.

Whereupon the meeting was declared adjourned by Chairman Mabee.

APPENDIX 'Sd.'

INSPECTION TRIP THROUGH THE CANALS WEDNESDAY AND THURSDAY, 12th AND 13th OF JULY, 1905.

The SS. "Frontenac having on board the members of the commission, with the exception of Mr. George Y. Wisner of the American section who had to leave the previous evening for home, the secretary of the Canadian section and a stenographer, left Victoria Pier at 7 a.m. and 20 minutes later entered the Lachine canal, at the Western end of the harbour. It took the steamer 2 hours and 20 minutes to pass the different locks of that canal, which is 8½ statute miles in length. There are 5 locks of 270 feet by 45 feet. The total lockage is 45 feet, depth of water on sills at two locks is 18 feet and at three locks 14 feet. The average width of the new canal is 150 feet. The old lift locks of 200 feet by 45 feet are still available with 9 feet of water on mitre sills. The canal consists of one channel, with two distinct systems of locks, the old and the enlarged. There are two locks entrances at each end.

The canal extends from the city of Montreal to the town of Lachine, overcoming the St. Louis Rapids, the first of the series of rapids which bars the ascent of the River St. Lawrence. The Government of Canada has spent, from 1843 to 1848, for the original construction of the Lachine canal $2,587,532.85. In 1869 the Government spent an additional sum of $2,000, making a total expenditure up to June 30, 1869, of $2,589,532.85.

The total expenditure for the enlargement of Lachine canal up to June 30, is $8,591,631.27. The Department of Railways and Canals has expended during the year ended June 30, 1904, $181,487.06, and from June 30, 1904, to October 1st of the same year, an additional amount of $20,339,59 has been expended, making a total expenditure for construction and enlargement to October 1st, 1904, of $11,382,990.77.

It was 9.48 a.m. when the 'Frontenac' left the Lachine canal at its western end. Before proceeding any further it will be interesting to give here a brief history of the Canadian canal systems:—

The River St. Lawrence, with the system of canals established on its course above Montreal, and the Lakes Ontario, Erie, St. Clair, Huron and Superior, with connecting canals, afford a course of water communication extending from the Straits of Belle Isle to Port Arthur, at the Head of Lake Superior, a distance of 2,000 statute miles. The distance to Duluth is 2,343 miles. The distance to Chicago 2,272 miles.

From the straits of Belle Isle, at the mouth of the St. Lawrence, to Montreal, the distance is 986 miles. From Quebec to Montreal, the distance is 160 miles. Owing to the shallowness of the waters on a portion of the river between these two places, particularly through Lake St. Peter, vessels drawing more than from ten to twelve feet were formerly barred from passage for the greater part of the season of navigation. In 1826, the question of deepening the channel was first definitely mooted, but it was not until 1844 that any dredging operations were begun. In that year, the deepening of a new straight channel was commenced, but the scheme was abandoned in 1847. In 1851 the deepening of the present channel was begun. At that time the depth of the channel at low water was 10 feet 6 inches. By the year 1869 this depth had been increased to 20 feet, by 1882 to 25 feet, and by the close of 1888 the depth of 27½ feet, at low water, was attained for a distance of 108 miles from Montreal to a point within tidal influence. This work is now being continued by the Government of Canada, which in 1888, under the provisions of the Act 51 Vic., ch. 5, of that year, assumed the indebtedness. The channel has a minimum width of 300 feet, extending to 550 feet at points of curvature. The channel is lighted and buoyed, and will have soon a depth of 30 feet all through.

Navigation, which is closed by ice during the winter months, opens about the end of April.

Montreal has by this work been placed at the head of ocean navigation, and here the canal systems of the River St. Lawrence begin, overcoming the various rapids by which the river channel upwards is obstructed, and giving access through the St. Lawrence canals, the Welland canal, the great lakes and the Sault Ste. Marie canal, to the head of Lake Superior.

The difference in level between the point on the St. Lawrence, near Three Rivers, where tidal influence ceases, and Lake Superior, is about 600 feet.

The Dominion canals constructed between Montreal and Lake Superior are the Lachine, Soulanges, Cornwall, Farran's Point, Rapide Plat, Galops, Murray, Welland and Sault Ste. Marie. Their aggregate length is 73 miles, total lockage (or height directly overcome by locks), 551 feet. The number of locks through which a vessel would pass on its passage from Montreal, at the head of ocean navigation, to the head of Lake Superior is 48. The Soulanges canal takes the place of the Beauharnois canal; the latter may be abandoned for navigation purposes.

Communication between lakes Huron and Superior is obtained by means of the Canadian Sault Ste. Marie canal, and also by the St. Mary's Falls canal, situated on the United States side of the River St. Mary. All these canals are now free of toll.

It is important to note that the enlargement of the canals on the main route between Montreal and Lake Erie comprises locks of the following minimum

dimensions: length, 270 feet; width, 45 feet; depth of water on sills, 14 feet. The length of the vessels to be accommodated is limited to 255 feet. At Farran's, in the canal of that name, the lock is 800 feet long. A similar lock is built at Iroquois on the Galops canal, the object being to pass a full tow at one lockage.

At 11.20 a.m. the 'Frontenac' entered the Soulanges canal which extends from Cascade Point to Coteau Landing, overcoming the Cascade Rapids, Cedar Rapids and Coteau Rapids. The length of that canal is 14 statute miles. There are 4 lift locks and 1 guard lock. The dimensions of the locks are 280 feet by 45 feet. The total lockage is 84 feet. The depth of water on sills 15 feet; the breadth of the canal at the bottom is 100 feet; the breadth of the canal at water surface is 164 feet and the number of arc lights is 219 of 200 candle power each. From the head of the Lachine canal to the foot of the Soulanges canal the distance is 16 miles. The works of construction of the Soulanges canal are completed. It costs, $6,852,047.52.

The ss. 'Frontenac' left the Soulanges canal, at Coteau Landing, at 2.22 p.m., taking therefore a little over three hours to go through the various locks.

From the head of the Soulanges canal to the foot of the Cornwall canal there is a stretch through Lake St. Francis, of 32¾ miles, which is being made navigable for vessels drawing fourteen feet. The 'Frontenac' entered the Cornwall canal at 4.25 p.m. This canal extends from the town of Cornwall to Dickinson's Landing, a distance of 11 miles. These works are completed, with the exception of the machine shop and office, the electrical appliances, the enlargement of the old weir at lock 17, and the strengthening of the bank opposite the town of Cornwall, all of which works will be finished before the close of the present season of navigation. The length of this canal is 11 statute miles; there are 6 locks of 270 feet by 45 feet; the total lockage is 48 feet; the depth of water on sills 14 feet; the breadth of the canal at the bottom 100 feet; the breadth of the canal at water surface 164 feet. The old lift locks, 200 feet by 45 feet, are also available with 9 feet of water on mitre sills. The total expenditure on construction and enlargement to October 1, 1904, is $7,090,767.26. It was 9 p.m., when the 'Frontenac' stopped at Dickinson's Landing, having taken 3 hours and 35 minutes to pass through the locks of the Cornwall canal. She laid all night alongside the wharf at Dickinson's Landing.

THURSDAY, July 13th, 1905.

The 'Frontenac' left Dickenson's Landing at 5.45 a.m., and, at 6.15 she entered the Farran's Point canal, which commences at Farran's Point and extends a mile westward. The 'Frontenac' took just 10 minutes to pass through this canal which has only one lock. The new one is 800 feet by 45 feet and the old lock of 200 feet by 45 feet; the total lockage is 3½ feet; the depth of water on sills of the new lock is 14 feet; the depth of water on sills of the old lock is 9 feet; the breadth of the canal at the bottom is 90 feet, and the breadth of the canal at water surface is 154 feet. From the head of the Cornwall canal to the foot of Farran's Point canal, the distance on the River St. Lawrence is 5 miles, the latter canal enables vessels ascending the river to avoid Farran's Point rapid, passing the full tow at one lockage. Descending vessels run the rapids with ease and safety. The work of enlargement of this canal is completed. The total expenditure for construction and enlargement up to October 1, 1904, is $881,954.73.

From the head of Farran's Point canal to the foot of Rapide Plat canal, there is a navigable stretch of 10½ miles. The 'Frontenac' entered the Rapide du Plat canal at 8.25 a.m., and left it at 9.21 a.m, taking, therefore, 56 minutes to go through its two locks. The length of the canal is 3 2-3 miles. The dimensions of the locks are 270 feet by 45 feet; the total rise or lockage is 11½ feet;

the depth of water on sills is 14 feet; the breadth of the canal at bottom is 80 feet, and the breadth of the canal at surface of water is 152 feet. The old lift lock, 200 feet by 45 feet, is also available, with 9 feet of water on mitre sills. The work of enlargement on this canal is completed with the exception of work at the upper entrance which will be completed this season. The work consists of masonry upon the upper entrance pier. The total expenditure in that canal, up to October 1, 1904, is $2,151,056.86.

From the head of Rapide du Plat canal to Iroquois, at the foot of the Galops canal, the St. Lawrence is navigable 4½ miles. The 'Frontenac' entered the Galops canal at 9.52 a.m., and left it at 11.20 a.m., taking, therefore, one hour and 28 minutes to go through the three locks of the Galops canal, which enables vessels to overcome the rapids at Pointe aux Iroquois, Pointe Cardinal and the Galops. The works of enlargement of both the Iroquois section and the Galops section of this canal are completed. The proposed wharf at the upper entrance of the Cardinal cutting has not yet been completed, but it is expected that it will be finished by the end of the present season of the navigation. The total expenditure of this canal, up to October 1, 1904, is $3,564,366.27. As above stated, there are 3 locks in that canal which is 7 1-3 miles in length; the dimensions of two of those locks are 270 feet by 45 feet, and the third one, which is a guard lock, 800 feet by 45 feet; the total rise or lockage is 15½ feet; the depth of water on sills 14 feet; the breadth of the canal at the bottom 80 feet, and the breadth of the canal at surface of water 144 feet. The distance from the western end of the Galops canal to the city of Kingston is 67½ miles. The SS. 'Frontenac' arrived at the dry dock basin, in that city, at 6.30 p.m.

The Chairman and the Secretary of the Canadian section drove immediately to the residence of His Worship the Mayor of Kingston to inform him that the Commissioners were ready to hear the various public bodies if they had any views to present before them, and a meeting on board the SS. 'Frontenac' was arranged for 9 o'clock p.m.

The Kingston gentlemen who appeared before them were: Ald. King, Secretary of the Dominion Marine Association, representing the Mayor and City Council; E. J. B. Pense, M.P.P., H. W. Richardson, Hiram Calvin, Sanford Calvin and L. L. Henderson. The local men gave no expert evidence, but urged against the construction of a dam at the foot of Lake Erie if it would in any way interfere with the level of the waters of Lake Ontario; they also advocated the deepening of the Welland canal. They were assured in the strongest terms by different members of the commission that nothing would be done that would injure in the slightest the interests of those depending on the lower waters.

The conference began shortly after nine o'clock.

The Chairman, after referring to the absence of Mr. Wisner, spoke of the object of the commission.

One of the questions referred to the commission was the raising of the low level in Lake Erie; one way being to construct controlling works at the foot of Lake Erie in the Niagara river. The commission had to report on what effect this would have on the levels of Ontario and the river. The matter had taken no definite shape as yet. The commission had power only to collect information and report to the Canadian and American Governments; the suggestions made might be rejected by either. Nothing could be done save by a treaty arranged between the two countries.

Alderman King was the first speaker. The Council felt doubtful as to the exact object of the commission. But he was authorized to say that the views of the Dominion Marine Association as expressed in Montreal were endorsed by the City Council. But he would say that the Council protested very respectfully but emphatically against any action that would lower the level of this lake. There were others, however, who could speak with knowledge of the subject.

Mr. H. W. Richardson next spoke. He had only known of the meeting less than an hour before. He could see the advantage of having a minimum depth in Lake Erie for loads of ore, etc. He was not prepared to say what effect a dam in Lake Erie would have, but nothing should be done to lower the level of Lake Ontario, for it was hard enough to navigate it and the river as it was. He had always advocated grain being taken through the Welland canal without breaking bulk down to the end of Lake Ontario; the benefit would be fully two cents a bushel, and thus Canada could compete with the Buffalo route.

Mr. Hiram Calvin said he wished to enter his protest against a scheme that proposed to shut off any of the water supply of Lake Ontario. It did not take an engineer to see that the scheme would injure this lake, unless a similar dam was placed near Ogdensburg to control the level of Lake Ontario as well. He did not believe Lake Erie level needed to be raised. If the boats were made wider and longer they could get all the bulk they needed. They had gone up to 560 feet and would increase this. The people here objected to being robbed. He wished to put in his word for an enlarged Welland canal. Big cargoes could not be brought down here without it.

Mr. L. L. Henderson spoke for the I. T. Co. In opening, he remarked that the damming of Lake Erie would also mean the "Damning" of Lake Ontario. (Laughter). An objection had been raised that boats in Lake Erie scraped the bottom. If the lake was raised two feet the boats would still strike the bottom, for in his experience grain men loaded boats up as much as they could. If the lake was raised, the area would be increased, and this could not but affect Lake Ontario. There was supposed to be a 14 foot channel to Montreal. This was all right now, but they could not get this later in the season. He would emphatically protest if it was going to lower the level 1-40 of an inch. His friends to the south were building a 1,000 ton barge canal. If the Welland canal were properly enlarged 1,000 ton barges could go through and 90 per cent of the trade would go down the St. Lawrence, and the new American canal would be as much in the background as the present Erie canal. The yield of grain in the Northwest would soon be 100,000,000 bushels, and the saving of two cents a bushel would be enormous.

In answer to a question of Mr. Clinton, Mr. Henderson said there was no regular low water season. This year it had been in the spring. The water usually began to go down again in August. At the present time it was about eighteen inches above the level.

Mr. Pense was the concluding speaker. He had had little experience in marine matters, the most being bumping up against rocks on the shore(Laughter). Kingston had naturally a very selfish interest in transportation, and she had not developed in this line anywhere near what she would. One of two courses would undoubtedly be adopted by the Government; either the Welland canal would be deepened and the Georgian Bay canal put through, for Canadians would not, in their present spirit, allow their rivals to the south to get ahead of them. As to the Niagara Falls power, the Ontario Legislature would be petitioned for rights to that power, and the present works there would likely be greatly multiplied. Kingston had a great reliance in what was done in Montreal, for the marine interests were identical. He was sure the two countries would go hand in hand and do nothing that was not for the best interests of all. He thanked them for the opportunity of hearing even Kingston's selfish views.

Mr. Clinton, one of the Commissioners, was called on by the president to speak with regard to the proposed dam near Buffalo. The purpose of enlarging the Erie canal was not mainly to retain the through grain trade. It was mainly for regulating the rates. Secondly, there was a lot of local trade that had exceeded the through trade. The American Commission was to report not on the dam, but the advisability of regulation works at Niagara.

They would not think of doing anything to injure the rights of those below Lake Erie. They had 'vested rights,' and no recommendation would be made to interfere with these. The only fear was that both sides might make mistakes, but they would endeavour not to do.

Colonel Ernst, chairman of the American section, said the object in inquiring into Lake Erie was to have lower water at high water, and higher water at low water. They need have no anxiety as to any injury to the waters of Lake Ontario.

Mr. Louis Coste said he would take care of the interests of the St. Lawrence, as he had in the past. If there was any doubt he would give the lower waters the benefit of the doubt. Mr. Wisner, who was absent, and had prepared the report, said he had given no study as to what effect the work would have on the lower waters, as no data was present. Some had been already secured since, and all that was thought necessary would be obtained before the commission finished its work.

Mr. W. F. King said he had to thank the Kingston gentlemen for bringing up certain questions that would have to be investigated. An impartial investigation would take place, not only internationally but as between the upper and lower waters.

The chairman asked the Kingston men to compile any statistics they wished and send it to the secretary. He could assure them the commission would not imperil the great and growing interests of Lake Ontario and the St. Lawrence. The American Government would take no step towards injuring the St. Lawrence ports. It would rest with those who wished to raise Lake Erie to show beyond a doubt that this would cause no injury below. It would depend largely on expert evidence. At the time water was wanted worst in Lake Erie it was wanted worst below. He again assured them that no recommendation of the commission would injure their interests.

Before closing Mr. Coste asked if any record of the gauge of the water had been kept here, but was answered in the negative.

In reply to a question Mr. Henderson said that easterly winds would lower the water at least a foot and stop navigation for days.

After the close of the conference the Kingston men spent a pleasant social half hour with the members of the commission.

After the gentlemen from Kingston had left the steamer, the commission sat during a few minutes, to fix dates for subsequent meetings. It was decided to sit in Buffalo on September the 11th and 12th; at Niagara Falls on the 13th and 14th of the same month; in Toronto on September the 15th and in Hamilton on September the 16th. The Secretary was instructed to communicate with the public bodies and the various corporations interested in the conditions and uses of the waters of Lake Ontario and Lake Erie and Niagara river and to inform them of the dates arranged so that they may be ready to present their views before the commission.

Being eleven o'clock P. M., the meeting was declared adjourned and the Commissioners left by the night train for home.

APPENDIX 'Se.'

Briefs submitted at a public hearing held at Niagara Falls, N.Y., September 14, 1905, by representatives of the various power companies and others interested in the uses and conditions of the waters of Niagara Falls, the waters of Niagara river and of the Great Lakes, in the proposed regulation of the levels of the Great Lakes. Brief No. 1 submitted by Hon. A. K. Potter of the State Reservation at Niagara at the public hearing of September 14, 1905.

To the International Waterways Commission of the United States and Canada:—

The Commissioners of the State Reservation at Niagara Falls, New York, have requested your respective Commissions to lay before your several Governments the urgent necessity of protecting the Falls at Niagara from further depletion. With this in view, Mr. Dow, its President, has presented to your honourable body a brief setting forth important data and urging you the reasons more particularly, for preserving the scenic beauties of Niagara.

At the request of our Commission, I desire to present to you certain other reasons, which are more particularly addressed to the legal and practical aspects of the question. There are two aspects of the question, international and national. I first ask your attention to the international aspect of the case.

The Niagara river is not only a national boundary, but it is, in contemplation of law, throughout its entire length, a navigable stream. The two countries which it separates are bound by treaty obligations and by the Common Law of each land, to maintain it as a navigable stream. The waters of Niagara river cannot be lowered upon one side without the corresponding loss of water upon the other side. The public, as such, which in the United States at least means the entire people, and I suppose the same is true in Canada, have the right to the use of the waters of Niagara river for purposes of navigation, and to require of the Government that the navigability of the river be preserved from any encroachment upon the one side or the other. That the Niagara river throughout its entire length, is, in law, a navigable stream and therefore subject to the laws which govern navigable streams, and which give the people at large a right to the use of them, has been held in the United States Courts and in the Courts of the State of New York; and it has also been held that this is so, notwithstanding the interruption of navigation by reason of the Falls and the Rapids. But the river is, in fact, navigable as far down as Port Day on the American side, and as far as Chippewa on the Canadian side of the river, and has been in fact navigated to those points, and these are below the point which water is likely to be taken from the river for hydraulic purposes. Briefly speaking, it is clearly within the power, and becomes the duty, of the respective Governments to preserve the rights of the public of each country in this stream, for the purposes of commerce. It is a mutual obligation because, as I have said, any injury to navigation on either side is an injury to the rights of the public on both sides. And, if there should be injury to navigation upon one side, the country upon the other side would feel in duty bound to have such injury restrained, which might lead to undesirable international complications.

Upon the national side of the question, I address myself more particularly to the Commission appointed by the President of the United States. The Constitution distinctly gives to Congress the power to regulate commerce between the States and with foreign countries. It also gives to Congress the power to pass any legislation necessary thereto. The ordinance of 1787, establishing the Northwest Territory, distinctly provides that all waters leading to the St. Lawrence river shall be kept open and free to the citizens of all the

country; and this compact has been recognized as still in force by the Federal Courts. The chart made for the United States, under the supervision of Major Symons, 1902, lays down the course of navigation to a point near Port Day on the American side and also to Chippawa on the Canadian side, and shows that the depth of water along these lines will stand no further diminution if the river is to be kept as it has been, to these points, open to navigation. Mr. Dow in his brief, has set forth the effect of concessions already made for hydraulic purposes upon the depth of water on the American side. It shows that the navigability of the stream is already threatened, and that it is liable to be considerably injured when the concessions already made, have been put into use.

For the reasons I have stated, it is plain that it is not only within the power but within the absolute duty, of the United States Government to take steps, by appropriate legislation, or possibly by a treaty with Great Britain, to prevent the destruction of the rights of the public in this stream. A. K. Potter, Commissioner.

At a meeting of the Commissioners of the State Reservation at Niagara Falls, held at their office on the 13th day of September, 1905, the following resolutions were adopted:—

'Upon motion of Commissioner Potter,

'Resolved: That this Board earnestly requests the International Waterways Commission to urge upon their respective governments the necessity and reasons for preventing the further diversion of the waters of the Niagara river from their natural course over the Falls;

'Resolved: That the Superintendent be directed to furnish to each Commissioner a copy of the foregoing resolution.'

Above is a copy of the minutes of the Commissioners of the State Reservation at Niagara Falls, New York.

EDWARD H. PERRY,
Superintendent.

Brief No. 2, submitted by Charles M. Dow, President of the Commissioners of the State Reservation at Niagara to the International Commission.

Gentlemen:—As President of the Commissioners of the State Reservation at Niagara I welcome you to this place of meeting, and thank you for this opportunity to lay before you certain facts concerning the subject which you have under consideration affecting the interests of the people of the State of New York in the Falls of Niagara.

Although the scope of your inquiry embraces vast commercial interests tributary to the five great lakes and their outlets, yet it is a fact with which you are doubtless familiar that the federal legislation resulting in the creation of your Commission had its genesis in the apprehensions concerning the effect of the artificial diversion of waters coming in the course of Nature to Niagara Falls, and was proposed by my late predecessor as President of the Commissioners of the State Reservation at Niagara.

Therefore, while not unmindful of the great commercial interests involved in the 5,000 miles of Great Lake coast line in the United States and Dominion of Canada, I shall confine my observations solely to the consequences ensuing upon any further material diversion from the Falls of Niagara. Fortunately both sets of interests have much in common, and measures which will conserve one will conserve the other.

In the first place, let me say that the considerations affecting the property which we have in charge are very different from those affecting the strictly commercial questions which will absorb your attention elsewhere, and, we trust, will be approached by you in a different mental attitude. There are large

financial consequences involved in the maintenance of the volume of Niagara, of which we shall speak later, but first and foremost comes the very unusual but none the less important consideration of maintaining Niagara Falls as a great natural spectacle.

The State Reservation of Niagara was created solely for the preservation of the beauty and grandeur of this exceptional scene. It was done under no subterfuge of utilitarian ends. The purpose was frankly declared in the legislative act to be 'the preservation of the scenery of the Falls of Niagara.' In this action by the State of New York and the action soon following by the Dominion Government, our two governments have undertaken a trust, to protect which we are morally responsible not only to the people of our respective jurisdictions, but also to the people of the civilized world.

Let us consider some of the physical facts affecting the volume of Niagara Falls and the causes for fear concerning its maintenance.

From June 10 to Sept. 17, 1868, the United States Engineers measured the volume of the Niagara river near its head and found the mean to be 273,329 cubic feet per second. For the past thirty-six years since its publication in 1869, this figure has been more frequently quoted than any other as representing the volume of water passing over the Falls of Niagara. As a matter of fact, the discharge during that particular period was largely in excess of the average mean for an extended period, and later figures given by the United States Engineers reduce the average mean flow for forty years to 222,400 cubic feet per second. To this may be added the inflow from streams entering the river between Lake Erie and the Falls, making 224,000 cubic feet per second the figure now generally accepted by engineers in their calculations. (See ' The Menace to Niagara' by Dr. John M. Clarke, New York State Geologist, in 'The Popular Science Monthly' for April, 1905). A Recent recalculation by Dr. Clarke gives 3,800,000 horse power as the equivalent of this discharge.

Now it is self-evident that the volume of the Falls as a whole will be reduced in proportion to any subtraction of water from the river above them, but the volume of the American Fall and the Canadian Fall will be affected unequally for the following reasons:

1st. About 6-10 of a mile above the Falls the stream is divided by the apex of Goat Island. This point of division is about 750 feet from the American shore and 3,750 feet from the Canadian shore. If the cross-section of the river-bed were horizontal, the gradient equal and the current parallel with the midstream line, this would divide the flow in the ratio of 1 to 5, giving the American Fall one-sixth and the Canadian Falls five-sixths of the flow.

2nd. But the cross section of the bed of the river is not horizontal, the bed being higher on the American side and tending to send the water by gravity toward the Canadian side. As a consequence, the sill, or rock edge of the American fall is ten feet higher than the sill of the Canadian Fall according to a statement of the State Geologist, made this year.

3rd. The channel widens from the parting of the waters at the head of Goat Island to the American Fall, thus spreading the small proportion of water received thinly over a crest line of 1,060 feet; while the channel on the other side contracts, tending to deepen the water passing over the Horseshoe fall.

As the result of the first two factors, it is variously calculated that only from one-tenth to one-fifth of the volume passes over the American Fall. James Wilson, Superintendent of the Queen Victoria Niagara Falls Park estimates 10 per cent as the American Fall's quota. Isham Randolph, advisory engineer estimates it at 15 per cent. An engineer consulted by the State Geologist of New York estimates it at about 18 per cent.

As the result of the third factor mentioned,—the widening and contracting of the respective channels,—the discrepancy in depth of water on the Falls is made even greater. This difference is apparent in many ways. In winter

time, cakes of ice eighteen inches thick touch the sill of the American Fall in passing over, while they flow freely over the Horseshoe Fall. The American cataract is too feeble to move the limestone rods that lie at its foot, while the rocks from the Horseshoe Fall are moved and spun by the tremendous volume of the cataract. Another index is the rate of erosion and recession of the Falls, which is about three times as rapid on the Horseshoe as on the American Fall. In plotting the crest lines of the Falls, engineers can see the outlines of the American sill through the water with sufficient distinctness to survey it readily, but on the Horseshoe Fall the position of the sill can be determined only by other criteria.

A competent hydraulic engineer, at the request of the State Geologist, has calculated that the subtraction of 40,000 cubic feet per second (about 10 per cent) from the Niagara river above Goat island will draw the water down to the rock bottom edge of the American Fall, leaving a miserable little film dribbling over the sill; and that the subtraction of 40,000 cubic feet more, or 80,000 cubic feet per second in all, will dry up the American channel completely, while the Canadian channel will still be an object of interest.

Now let us see what preparations have been made to lead us to that lamentable result.

In 1902, a Syndicate applied to the Commissioners of the Queen Victoria Niagara Falls Park for permission to erect a new power plant on the Canadian side. The three Companies already installed there protested vigorously but unsuccessfully and the new plant was authorized. In the account of the investigation conducted by the Commissioners, which appears *in their 17th Annual Report*, the following figures appear:

Water required for chartered developments now in operation on Canadian side:—

	Cubic Feet per Second.
Ontario Power Co.	12,000
Toronto & Niagara Power Co.	11,200
Canadian Niagara Power Co.	8,900
Total	32,100
Four new developments suggested	29,996
	62,096

American developments now in operation and arranged for call for the following volumes of water:—

	Cubic Feet per Second.
American Niagara Falls Power Co.	8,600
Niagara Falls Hydraulic & Manufacturing Co.	7,700
Total on American side	16,300
Total on Canadian side	62,096
	78,396

The Advisory Engineer, Isham Randolph, continues: '78,396 cubic feet per second out of a total of 222,400 cubic feet per second, or an appropriation of 35¼ per cent of the available water to develop power, leaving 144,006 cubic feet to continue *the scenic effects of the cataract.*'

But by that time, the 'scenic effects of the cataract' so far as the American Fall is concerned, will have disappeared. The American channel will be dried out. Furthermore, Mr. Randolph has taken into account only a portion of the chartered development on the American side. The American Niagara Falls Power Co. can consume twice 8,600 cubic feet per second without exceeding its charter. The charter of the Niagara, Lockport and Ontario Power Co. contains no limit. The same may be said of other existing charters.

These facts show that the complete extinction of the American Fall and the serious reduction on the Canadian Fall are imminent. Such an event would be a national loss from which we may well ask you to devise some sort of protection. When power companies contend among themselves over the lowering of their water levels by rival companies, we deem it our duty, and it has been our consistant policy, to stand between them all and the public interests in the level of Niagara Falls themselves, which we regard of paramount importance.

My argument for the preservation of the beauty of Niagara Falls thus far has been based solely on aesthetic considerations—popular appreciation of their sublimity and national pride in them.

There is another and more material phase of the question, however, which cannot be overlooked.

The State of New York has invested in this Reservation about $2,500,000, counting appropriations for purchase, improvements, maintenance and interest. Whatever impairs the value of Niagara Falls as a spectacle impairs the value of that investment.

In the next place, about 800,000 persons visit Niagara Falls every year. It would be difficult to compute the amount of income which this brings to the railroads, hotels, merchants and other business people of the State. A single railroad company, the New York Central, received $170,000 in fares during the three summer months of 1902 on account of its Niagara business alone. If these 800,000 visitors spent only $1.25 a piece within the State on account of Niagara Falls, the business on this account would amount to a million dollars a year, and we believe that figure might be multiplied several times and yet be within the limits of probability.

It is no part of my duty to suggest to you the justice of some international agreement which will regulate the proportion of water to be diverted from the Niagara river to commercial use on one side or the other, or of preventing diversions from the Great Lakes through drainage or commercial canals which will injure the financial interests at this point. The latter are fully competent to take care of themselves. But we do most earnestly urge you to devise and recommend some international agreement by which the further abstraction of water from Niagara river for purely private enterprises shall be stopped at once. The Legislature of the State of New York has formerly recommended such a course, and we believe that their resolution faithfully reflects the sentiment of the people at large.

We do not interpose our objection to the construction of absolutely necessary public works, nor do we apprehend that the greatest danger to Niagara Falls is threatened by them. Commercial canals diverting waters to the Mississippi, Hudson or St. Lawrence rivers require small volumes of water compared with power plants. The Erie canal now takes from Lake Erie only 600 cubic feet per second for about two hundred days in the year. Fourteen such canals could draw water from the Great Lakes and not reduce the flow at Niagara as much as one power plant developing 100,000 horse-power.

*Foot Note: This figure is printed "81,396." His other figures show that he means 78,396.

We believe that the Dominion of Canada and the United States have a common interest in the preservation of the Falls of Niagara. The treaty of Ghent, which fixed the international boundary in the Niagara river, devolves upon both governments the moral duty of protecting them. No conservative effort on the part of one can avail anything without the co-operation of the other.

We sincerely trust that the representative of the Dominion of Canada and of the United States on your Commission may be so impressed with the responsibility of each government to the other and of both to the world for the perpetuation of the grandeur of this scenic wonder, that your conferences will be crowned with a treaty which will protect for ever the beauty of Niagara Falls.

Brief No. 3 submitted by Mr. Geo. H. Wilkes, Commissioner of the Queen Victoria Niagara Falls Park at the Public Hearing of September 14, 1905.

Commissioners:—John W. Langmuir, Chairman, Toronto; George H. Wilkes, Brantford; Robert Jaffray, Toronto; James Bampfield, Niagara Falls; Archibald W. Campbell, Toronto. Superintendent:—James Wilson, Niagara Falls, Ont.

NIAGARA FALLS, 24th August, 1905.

To the Commissioners of the Queen Victoria Niagara Falls Park,
Niagara Falls, Ontario.

Gentlemen:—The International Waterways Commission, which has been appointed by the Governments of Canada and the United States to examine into and report upon all questions arising out of the joint waterways along the boundary line separating the two countries has appointed the 13th and 14th of September next for a consideration of the proposal made some years ago to erect a dam across the outlet of Lake Erie between Buffalo and Fort Erie for the purpose of raising the surface of the lake to a fixed stage of water level, and of constructing regulating sluices in the dam to permit of maintaining this proposed fixed stage at all times during the season of navigation.

As this proposed work, if carried out, would in my judgment have a very important bearing upon the supply of water to the Niagara river, below the dam, and would in all probability materially affect not only the riparian rights of the Commissioners along the bank of the river but also the supply of water to the hydro-electric industries licensed by the Commissioners to use the waters of the river at Niagara Falls for power purposes, I have prepared the following report upon the subject for the consideration of the Board.

Lake Erie is the fourth in the chain of five great inland waters through which the drainage of a large portion of the continent is passed on to the sea, and whose broad surfaces temper the heat of summer and the cold of winter and furnish the moisture required to irrigate a large district of country, the size, drainage, area and run off of these several lakes being approximately as follows:

Name.	Area of Water Surface Sq. Miles.	Watershed Square Miles.	Maximum Depth, Feet.	Average Run-off, Feet per Sec.
Lake Superior	32,000	48,600	1,030	72,000
Lake Michigan	22,400	45,700	1,000	.....
Lake Huron	23,200	52,100	1,000	190,000
Lake Erie	10,000	24,500	84	220,000
Lake Ontario	7,500	25,500	500	250,000

According to the 1904 report of the Chief Engineer U. S. Army, the drainage area of the lake region above Niagara river is 254,708 square miles.

As is shown by the above table, the outflow or runoff from Lake Erie as determined by taking a mean or average for a period of many years is 220,000 cubic feet per second, or 82,500,000 gallons per minute. Owing however to several causes this outflow is by no means uniform, the volume varying from hour to hour with the constantly changing elevation of the surface of the lake at the outlet. The causes of this variation are:

1. The precipitation and evaporation over the lake area which uniformly gives high water in mid-summer and low water in mid-winter.

2. A periodic variation which may be traced to a cycle of wet and dry seasons, extending over a period of years, this variation is in harmony with and emphasizes the general annual movement.

3. Wind storm upon the lake; while the effect is of short duration the surface of the water may be raised or lowered in a very short time to the extent of several feet, a southwest wind driving the water down the lake and piling it up at the outlet, and a north east wind forcing the water up the lake and thus lowering the level at the outlet.

So great have been the effects of the wind at times that the surface elevation at Buffalo has been raised as much as 8 feet above the normal, while on other occasions, the level has been lowered from 5 to 5½ feet below mean water level.

Under these circumstances it would appear that if the outflow could be made more uniform it would be highly beneficial to all interests concerned. The problem, however, is one of great magnitude, and requires very careful consideration in order that all the phases of the question may be taken into account. Fortunately this subject was under consideration in 1900 and a very exhaustive and carefully prepared report was made by a Commission of Engineers for the United States Government upon the subject, in connection with other proposed works for the improvement of the navigation of the upper lakes, and although the present International Waterways Commission are not in any way committed to the plan then devised and which was fully considered and illustrated in the report referred to, yet it furnishes an excellent example of the method and scope which the best engineering opinion of the day would be likely to suggest for a work designed to accomplish the desired end, and therefore will be here referred to in order to ascertain the effect which such a system of regulation would have upon the waters of the river *below* the site of the works, and consequently upon the levels and supply which would be available for the navigation of the river between the lake and Chippewa as well as for the important industries which have been established at Niagara Falls on both sides of the river for the development of electricity for commercial purposes.

In so far as regulating and maintaining the levels of Lake Erie is concerned there can be little question respecting the beneficial results which would follow from the construction of the projected works and were this the only question involved the proposal would meet with very general approval. As however, the project has a wider influence, it will be better to briefly describe the works designed for this point.

The regulating works proposed by the U. S. Deep Waterways Commission in 1900 provided for the construction of a concrete masonry overfall dam running out at right angles to the Canadian shore of the river from a point a little over a mile up stream from the ferry landing in the village of Fort Erie. This dam to extend out into the river for a distance of 1,600 feet from which point a system of masonry piers and movable steel gates extended a further distance of 1,210 feet, consisting of thirteen openings of 80 feet clear span, separated by piers twelve feet in thickness with grooves for the heavy movable stoney gates. Steel towers were designed to be erected over each pier to carry the lattice overhead work, and machinery for the raising and lowering of the gates. Beyond this regulation system of works, it was proposed to utilize an existing roof of rock

of the same elevation as the overflow dam to carry the work to Black Rock harbour, the latter part being at an angle of 35 degrees with the main portion of the work, and 1,200 feet in length.

Under this scheme, the free navigation of the river would cease and all vessels would require to use the upper reach of the Erie Canal in order to pass the proposed works, no lock having been provided for the Canadian side.

The top or crest of the overfall dam on the Canadian side and the surface of the reef on the Buffalo side of the regulating gates was fixed at an elevation of 4·5 feet below the present mean water level of the lake. The construction of the works were designed to raise and maintain the mean level of the lake 2·1 feet higher than at present.

At the established normal stage of the lake, or within the range of the monthly mean stages, or at any higher water level, the regulation could be made effective and that without changing the flow of the river to any material extent, but as has already been pointed out there are seasons when storms raise or lower the water surface abnormally, and it is at periods when low water prevails that the volume of water passing the works would be reduced to small dimensions, or, possibly if the low water period occurred during the season of navigation the supply might be cut down to such an extent as to make all use of the river impossible for navigation or in fact for any purpose and compel the closing down of all the works, for the generation of electricity, which are located along the course of the Niagara river, until the storm abated and normal conditions were restored.

From an examination of the fluctuations of the lake for a period of years, it appears that the average monthly minimum level of the surface is over two feet below the established mean, while on many occasions the water surface falls much below this, in several instances to five feet and on one occasion to 5.6 feet below the normal.

Doubtless the force of the wind would be felt to quite the same extent upon the regulated level, which would be 2 feet higher than at present, and a study of the resulting effect upon the outflow after the completion of the proposed works leads to the following general conclusions:

At the mean monthly minimum stage referred to, with all the gates open, the outflow would be about eight-tenths of the established mean flow, and, with the gates all closed only about four-tenths of the normal flow.

While at times of extreme low water caused by northeast winds, such as occurred in February, 1894 (when the lake at Buffalo fell 5.6 feet below mean level), there would be only one foot of head upon the overfall dam and the length of crest would also be reduced.

Under such conditions, with all the gates open, there would be only about one-third of the normal flow from lake to river pass the works, instead of fully one-half the normal as would be the case under similar conditions of exceptional low water with a free and unobstructed river. Should the gates be *all closed*, the flow would be restricted to only about one-twentieth of its mean volume. If this minimum elevation should happen at any time during the season of navigation, the shipping interests would of course use every effort to have the gates kept closed in order to secure the restoration of the levels of Buffalo harbour as quickly as possible after the storm abated, and as the shipping interests form a very powerful combination, and are likely to increase in importance, it is altogether likely that the gates would be kept closed, and the Niagara river allowed to run practically dry for the time being.

It is needless to point out that such an interference with the natural condition of affairs would not be permitted under any circumstances, particularly when the whole object of the scheme appears to be to save dredging the harbours on Lake Erie and to facilitate the making of a 21 foot channel from the United States side of the Niagara River to Lake Huron, the cost of which, according to the Deep Waterways Commission report before referred to would be, if the

water was raised in Lake Erie, to the extent proposed about $1,275,000 less than would be required should the conditions be allowed to remain as they now are.

I might be permitted to point out that already, owing to the construction of the Chicago Drainage canal, the water surface of Lake Erie has been permanently lowered according to the report of the Chief of Engineers, U.S. Army, (1904) by about 4½ inches and the volume of the Niagara river has been permanently reduced to the extent of four and a half per cent of its average yearly flow, and all the waters from Lake Huron via the St. Lawrence to the sea have been likewise despoiled to this extent for the benefit of the city of Chicago alone.

It is now proposed to further sacrifice the waters of the Niagara river and Falls by making them subordinate to the navigation interests on the Upper Lakes, to cut off the free use of the Niagara river by Canadian shipping, and compel it to pass by way of the Erie canal, which is state owned and not under the control of the central government, and to further jeopardize the flow down the St. Lawrence at seasons when inland and ocean navigation is in the greatest need of all the water which can possibly be had.

For all these reasons I am of the opinion that every effort should be put forth to oppose the erection of any such works at the outlet of Lake Erie as the dam and gates proposed by the U.S. Deep Waterways Commission.

Yours truly,

(Sgd). JAMES WILSON,
Superintendent.

Brief No. 4 submitted by Mr. F. L. Lovelace on behalf of the Niagara Falls Power Co. at the Public Hearing of September 14, 1905.

To the Honourable the International Waterways Commission.

Gentlemen:—Having noted that among the duties prescribed for your honourable committee is an investigation and report upon the maintenance and regulations of suitable levels of the waters adjacent to the boundary lines between the United States and Canada, and, further, upon the advisability of locating a dam at the outlet of Lake Erie, we are pleased to accept the opportunity which you have afforded us to protest against the construction of such a regulating dam and to set forth the manner in which it would injure the large investment represented by the power plant of The Niagara Falls Power Company.

Before presenting our argument it may be useful to give a brief description of the installation now made by this company as such a description will aid in clear understanding of the effect upon its power development of any construction at the foot of Lake Erie which would in anyway alter the existing levels of the Niagara river.

The Niagara Falls Power Company is a New York State corporation engaged in the development and sale of hydraulic and hydro-electric power, such power being used at the present time in Niagara Falls, Tonawanda, North Tonawanda, Lockport and Buffalo.

In order to avoid any defacement of the scenic beauties of the Falls, its plant was located about one and one-quarter miles above the American Falls. Its power houses are two in number, one on either side of a canal which leads the water to them from the Niagara river. Such canal is approximately 180 feet wide at the mouth, 125 feet wide at the upper end and has a length of 1,200 feet. The entire supply of water to the power houses passes through this canal, which has a depth of but twelve feet. (It may be remarked in passing that such depth could not be increased without shutting down the plant.) On the west side of the canal is power house No. 1, containing the earlier installation and

having a total capacity of 50,000 H.P., developed by ten units; while power house No. 2 on the east side of the canal contains eleven units, having an aggregate capacity of 60,500 H.P. As at least two units should be held in reserve, it may be considered that the entire installation has a total capacity of 100,000 E.H.P. The average head under which the turbines operate is about 140 feet, the water upon leaving the wheels being discharged through a tunnel to the lower river.

An idea of the substantial character of the construction employed in the plant may be gained from photograph No. 1502 of power house No. 2 accompanying this report, while the massive machinery is clearly shown in photograph No. 1504.

The product of this plant is used for the operation of electric railways, for electric lighting and other public utilities, upon which depend the convenience and even the safety of the inhabitants of the Niagara frontier. In addition to such public utilities many of the most important industries of Buffalo are supplied with their motive power by our Company and thousands of employees are dependent for their daily wages upon the uninterrupted supply of its electric current. A large number of manufacturing industries have located on the lands of The Niagara Falls Power Company. The value of these plants is over six million dollars and their employees number at least two thousand. These factories have been induced to locate here largely because they could thus obtain low-priced, uninterrupted power. Continuous service of electric current is most essential for their various processes and any change in the hydraulic conditions of the river which threatens to interrupt such service threatens to destroy the value of their vast investment; it threatens the happiness and prosperity of thousands of homes; it threatens the very existence of industrial Niagara.

In considering any form of regulating device at the foot of Lake Erie, the following objections present themselves as opposing the interests of the vested interests above described.

(1) These works have been constructed in the most permanent and substantial manner, after most exhaustive studies of the existing conditions in the Niagara river, and their hydraulics are based upon such conditions. It will be readily understood that even though other conditions might not be less favourable to new hydraulic developments, yet any change in the existing levels of the Niagara river must of necessity work to the disadvantage of plants now constructed, and would injure the immense vested interests represented by the largest plant in the world now employed in the production of electricity by means of water-power. Considering that the product of this plant issued for public utilities, where the convenience, if not the safety, of large numbers of persons depend upon a uniform supply of electric current, and in electro-chemical processes, where a short interruption of power produces serious monetary loss, it is clear that serious damage will be incurred if the water of the Niagara river is lowered even for a brief interval. We are concerned not only with the effect by the proposed regulating works upon the river levels through a considerable period of time, but even more directly with abnormal variations of short duration. The effect of decreasing by a small percentage the average flow for a year or even for a given month, is of small importance compared with abnormal fluctuations. It is pertinent to the question at issue to note that the mouth of the canal of The Niagara Falls Power Company is so located that at the present time the Niagara river has a normal depth of but from nine to eleven feet for a distance of 1,500 feet southerly therefrom. A variation in depth of water of only one foot, therefore, has a serious influence upon the supply of water to the canal.

(2.) A loss of head of one foot upon the turbine wheels of this plant would produce a loss of power, which if capitalized at 5% would be equivalent to a loss in investment of $285,000, considered solely from the standpoint of power production.

PHOTO No. 1502.—Showing Power House No. 2 of the Niagara Falls Power Co., at Niagara Falls, N.Y.

Photo No. 1504—Showing the Interior of Power House No. 2 of the Niagara Falls Power Co. at Niagara Falls, N.Y.

PHOTO No. 1434—Showing Ice Fields obstructing the Intake of the Niagara Falls Power Co. The ice is shown at the mouth of Main Canal; west side of same.

PHOTO No. 1434b—Showing Ice Fields obstructing the Intake of the Niagara Falls Power Co. Opening up channel in ice at the mouth of Main Canal.

PHOTO No. 1434e—Showing Ice Fields obstructing the Intake of the Niagara Falls Power Co. Putting in cribs and booms at the mouth of the Canal for protection against ice.

Photo No. 1444—Showing jam of ice outside of the booms which protect the intake of the Niagara Falls Power Co.

Photo No. 1222 Fighting Ice in the Canal of the Niagara Falls Power Co.

PHOTO No. 1223—Showing two piles of ice taken from the Canal of the Niagara Falls Power Co.

(3.) An even more serious effect of lowering the elevation of the water in the canal by even one foot would be the effect upon its velocity, such change resulting in an increase of velocity of more than 8% a consequent loss of head, and the carrying into the canal of large quantities of suspended matter which would prove injurious to the machinery. Such increased velocity during the winter months would also increase the flow of ice from the river, the ice problem being already one of the most serious with which the plant contends.

(4.) A most important consideration is the effect upon the ice conditions of any lowering of the river levels. The most difficult proposition which confronts a power plant in this latitude is to successfully combat the conditions which prevail during the winter months. While the current in the Niagara river is sufficiently swift in the main channel to prevent freezing under normal conditions, yet large quantities of ice carried down from the upper river lodge in the more shallow places on the American side of the river and rapidly freeze into a solid mass. The ice field extended southerly from the American shore for a distance of not less than 2400 feet during the past two seasons. This ice at times becomes of great thickness, owing to the adhesion to its under side of the anchor ice formed in the rapids. In some cases the ice freezes to the bottom of the river, thus forming an obstruction through which it is necessary to blast a channel to the deeper channel toward the Canadian side. An idea of the nature and extent of these ice fields may be gained by an inspection of photographs 1434, 1434b, 1434c, and 1444, accompanying this paper. Where the elevation of the water in the river falls even a small amount below the normal a vast quantity of the ice is drawn into the canal and requires most strenuous efforts and a large expenditure of money for its removal. Photographs Nos. 1222 and 1223 herewith presented, will indicate the results which follow a low water period of even short duration. With a normal depth of but ten feet and ice three feet or more in thickness, it is evident that to lower the water two feet is to reduce the cross-section by a very large percentage. This results in increased velocity toward the canal of The Niagara Falls Power Company and a consequent loss of head. The floating and anchor ice is drawn in by the rapidly moving current and still further chokes the waterway. It is only by the use of a large amount of dynamite and considerable forces of men that the plant can be kept in operation during these extreme conditions. A large amount of expense has been incurred for dredging with a view of overcoming, if possible, the ice difficulties which so frequently threaten continuous service during the winter months. If any change is made tending to decrease, even temporarily, the normal flow of the river, the consequences to our plant would be most disastrous. It is a well-known fact that within the past few years, ice jams have formed at the head of Goat island which completely shut off the water from the American Falls. This may be mentioned as an indication of the unstable condition of the river in winter and of the readiness with which the flow of water on the American side is completely interrupted. These conditions are not the result of power development, but existed for many years prior to the inception of the present projects. The old inhabitants bear testimony to the fact that an ice field has always formed from the American shore for a long distance southerly in the river. A study of the cross-section of the Niagara river at a point opposite Grass island, as made by the War Department Survey of 1875, would indicate that this condition might normally be anticipated, the shallows near the American shore forming natural obstacles to arrest the flow of the ice. This difficulty is greatly increased from the fact that the prevailing winds during winter are from the southwest, thus driving the ice toward the American shore, where it encounters a less rapid current and readily finds a lodgment.

It is important to observe that the normal existing flow in the Niagara river during the months of December, January and February is considerably below the average flow for the entire year By a consideration of the tabulated

statement of Monthly Mean Discharges of Lake Erie at Buffalo, New York, for the year 1865 to 1898 inclusive, as contained in the report of Mr. George Y. Wisner to the Deep Waterways Commission, it will be noted that the average discharge of the river for the period above mentioned is 220,428 cu. ft. per second, while the average flow for the month of December is but 209,204 cu. ft. per second; for the month of January 208,724 cu. ft. per second, and for the month of February 212,921 cu. ft. per second. Thus the normal monthly average discharge from Lake Erie is materially below the average for the year during those months in which the greatest difficulty from ice is experienced. This is especially noticeable in the year 1895, when the average discharge for the month of December was 180,956 cu. ft. per second; for the month of January, 1896, 182,348 cu. ft. per second. The latter figures closely approximate the minimum low water monthly flow noted in the report above mentioned, the lowest monthly discharge mentioned being that for November, 1895, i.e., 177,852 cu. ft. per second.

In brief, the ice situation on the American shore is in a condition of balance, where it requires but a sight decrease in the flow of the Niagara river, coupled with unfortunate wind conditions, to seriously interfere with continuous service to the most important industries of the Niagara frontier.

(5.) It may be argued that the wind is now the most important factor in determining the elevation of water on a given side of the river at a specified time, and that it would be difficult to learn by observation upon a given shore of the river whether the volume of the stream was large or small. While admitting this to be the fact, it is nevertheless true that the effect of the wind upon the lower Niagara will continue to have its present effects in an even more intensified form if at any time the flow of water in the river is so regulated as to decrease its volume. We may, therefore, expect that if regulating works are erected which at times decrease the volume of flow the existing minimum depth of water will be decreased by the decrease in volume of the stream. Such lowering of minimum depths will not be in direct proportion to the decrease in volume, but will be exaggerated owing to the fact that the wind will have a greater proportionate influence upon the depth of the water from which the supply of this company is obtained. It is probably that under given conditions of wind and ice a decrease in the flow of the river of not more than 20% below the past low water levels would entirely cut off the water from the American shore.

The Niagara Falls Power Company has taken accurate observations of the elevation of the surface of the water in the Niagara river since 1890. Such elevations were read twice each day from 1890 to 1902, and since that time have been continuously recorded by an automatic gauge. We beg to submit with this brief the following exhibits giving certain data derived from the above-mentioned observations and records, viz:

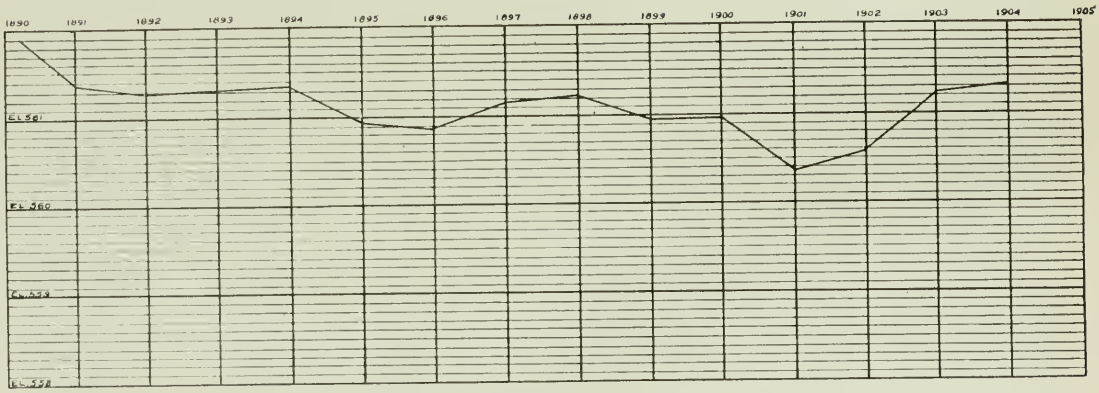
No. 4687—Curve showing yearly averages of daily readings of surface of water at mouth of canal from 1890 to 1905.

No. 4688—Curve showing monthly averages of surface of water at mouth of canal, 1895, 1901 and 1904.

No. 4689—Continuous record of elevation of water at mouth of canal for week ending January 17, 1903.

No. 4690—Same for week ending January 2, 1904.

These exhibits are of value in this connection not only as demonstrating the variation in the elevation of the surface of the river from year to year and month to month, but also the extremes of elevation which occur within short intervals. If other conditions are introduced which are liable at times to cause low water in the river, it is certain that such low water periods will at times be coincident with the existing conditions which cause such great difficulties to our plant by the lowering of the water level, and that such a combination will be serious and far-reaching in its results.



Curve No. 4687 Showing yearly averages of daily readings of surface of water at mouth of canal of the Niagara Falls Power Company from 1890 to 1905.

TORONTO PUBLIC LIBRARIES

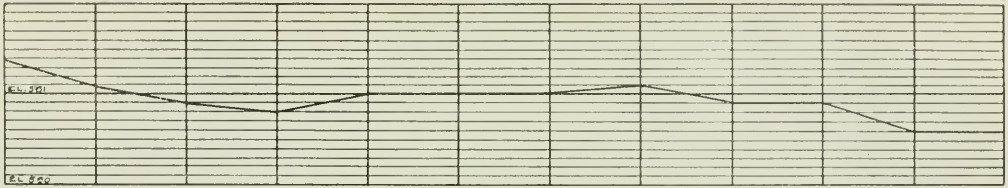
THE NIAGARA FALLS POWER COMPANY

Elevation of Water at Mouth of Canal

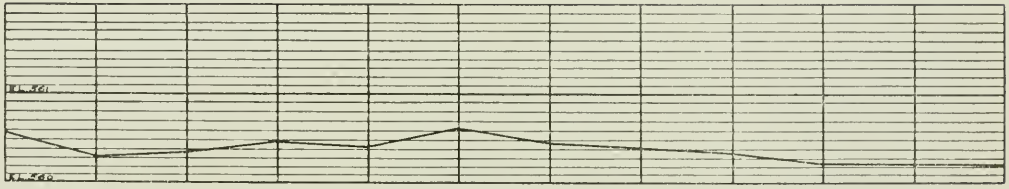
1895

Niagara Falls, N.Y., Sept 12 1908

JAN. FEB MARCH APRIL MAY JUNE JULY AUG. SEPT OCT NOV. DEC.

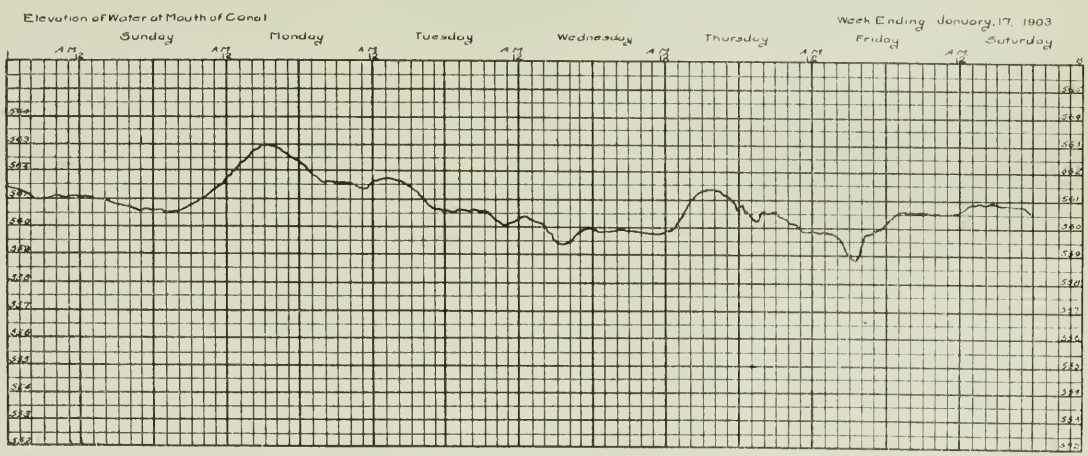


1901

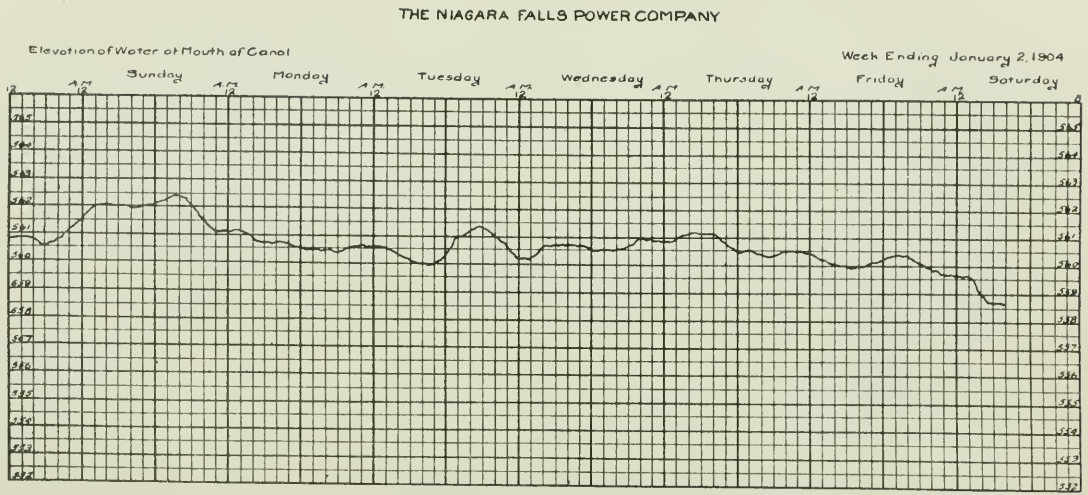


1904

CURVE No. 4688 showing monthly averages of surface of water at mouth of canal of the Niagara Falls Power Company, 1895, 1901 and 1904.



CURVE No. 4689 showing a continuous record of elevation of water at mouth of canal of the Niagara Falls Power Company for week ending January 17, 1903.



CURVE No. 4690 showing a continuous record of elevation of water at mouth of canal of the Niagara Falls Power Company for week ending January 2, 1904.

Such being some of the dangers which threaten the plant of the Niagara Falls Power Company if the levels of the Niagara river are disturbed by artificial means, or if they are lowered for even a brief interval below the normal conditions, it becomes pertinent to consider whether such effect would obtain if works were constructed to raise the elevation of the waters of Lake Erie. It may be remarked that the conditions are not affected to any marked degree by the exact elevation at which the surface of Lake Erie may be regulated, the general objections to regulating works being applicable whether such elevation is established at 573, or, as proposed by the Deep Waterways Commission, at 574·5.

It is understood that no definite plans for regulating works have been prepared by the existing commission, and any objections to such regulating devices must be based upon the general broad principles upon which they must of necessity be constructed. It is, nevertheless, difficult to understand how any plan can be adopted which would be an improvement, in its general form of construction over that proposed by the Honourable member of the present commission, Mr. George Y. Wisner, in a report which he made to the Deep Waterways Commission in 1898. As is well known, this plan consisted of a broad crested weir about 2,900 feet in length, located on either side of masonry abutments and stoney gates, which were to have an aggregate length of 1,200 feet. This carefully considered plan would appear to embody the essentials of any regulating works, namely, an overflow weir having a capacity equal to the low water flow and regulating devices for the discharge, when desired, of water in an amount equal to the difference between minimum and maximum flow. It is true that the lake level could be raised by means of a submerged dam, but such a plan would not seem flexible enough. Whatever plan may be adopted, whether based upon either of the above conceptions, or upon the use of devices which will automatically operate to preserve a uniform elevation of the surface of Lake Erie, the essential feature of all such devices must be a dam or weir, over which there will flow a comparatively shallow sheet of water. The length of such weir and the head under which it will normally act may, of course, be accurately designed to discharge the desired amount of water under normal conditions. Unfortunately, however, the conditions at the foot of Lake Erie can scarcely be considered to be normal, owing to the marked effect of the wind upon the surface of that lake. Extremes of variation of nearly fourteen feet have arisen from this cause, and changes of three feet below the normal are not uncommon. Even at the present time, the cross-section of the river is such that the direction of the wind has a pronounced effect upon the volume flowing in the river. A cross-section of the river at the site of the proposed regulating works would appear to consist of approximately 1,100 feet with 4 feet in depth below elevation 571½; at 1,400 feet having a depth of 20 feet below the same plane, at 1,200 feet 15 feet in depth. It is quite evident that the effect of a change in elevation of the lake surface of a given amount would have much less effect upon the volume of the existing flow in such a cross-section than upon that passing over any weir, either broad-crested or submerged. A brief inspection of the formula enployed for obtaining the flow of water over the weir section of the works originally proposed will emphasize this fact. Assuming that the coefficient c in the formula Q—CLh 3-2 to remain constant at 3·54, regardless of the submergence from back water, which would not materially affect the illustration, it will be noted that with a depth of flow over the weir of 6.6' the discharge is 175,000 cu. ft. per second; with a depth of 6' a discharge of 150,910 cu. ft. per second; at a depth of 5½' 132, 430 cu. ft. per second; at a depth of 5' 114,773 cu. ft. per second; while with a depth of 4½' the discharge is but 98,040 cu. ft. per second. A decrease of 2 feet in the depth of flow over the weir would, therefore, decrease the flow in the Niagara river by approximately 44%. While it is clear that this condition would not continue for any great length of time, it is equally apparent that a strong easterly wind might readily lower the water at the foot of the lake at

least 2 ft. at a time when the flow was at or near its minimum. Under these conditions, there would be no water whatever passing over the American Falls, or to the power plants on the American side, only the deeper section of the river being filled. While this illustration may not have a quantitive value, the assumptions made therein are fair and clearly indicate what may be expected from any form of weir construction. While it is true that the flow in the river could be increased by opening the gates in the regulating dam, yet it would seem extremely improbable that this would be done, for the lowest water of the year usually occurs in October and November when shipping interests would strongly oppose any action which would decrease the depth in Lake Erie. It is a frequent occurrence, especially in the winter months, to have a strong westerly gale which would blow the water toward the easterly end of the lake and thus cause an abnormal flow in the river, to be succeeded by an easterly storm which would sweep the water toward the upper end of the lake. Under these circumstances, the low water condition in the river might prevail for many hours, thus depriving the Niagara frontier of many of the most important public utilities. The above objection applies also to the plan which would be least detrimental to the interest on the Niagara river, namely, a plain overflow dam without regulating devices. Regulating gates are especially objectionable, as they would be introduced for the purpose of regulating the levels of Lake Erie in the interests of navigation and not for the welfare of either the power plants on the Niagara river, or of the scenic effects which attract so many visitors to Niagara Falls.

It is difficult to understand how a decrease in the flow of the river and consequent lowering of the water levels could be avoided, regardless of the exact design employed, during the period in which the waters of the lake were rising from their present level to the desired elevation. The average elevation of the surface of Lake Erie from the years 1891 to 1898, inclusive, was 571·68, or 2·82 ft. below the proposed regulated elevation of 574·5. To obtain this storage in six months would be equivalent to decreasing the flow in the Niagara river by 49,000 cubic ft. per second during that period, or about 28% of the low water flow. Such a decrease in the flow of the river, combined with other unfavourable conditions which might readily exist, would render the operation of our plant most difficult, if not impossible.

The regulating works designed by the Deep Waterways Commission in 1898 for the regulation of Lake Erie contained no provision for the navigation of the Niagara river aside from the construction of a canal around the regulating dam on the American side of the river. In any form of regulating device which may be adopted, the necessity of locks would be equally great. The introduction of such locks will interfere with the free navigation of the river, and, therefore, be most detrimental to the interests of The Niagara Falls Power Company. This company is the owner of lands adjacent to the shore of the Niagara river for a length of approximately two miles, together with valuable riparian rights connected therewith. It would require but a comparatively small expenditure for dredging to obtain a depth of fourteen feet at mean water from Buffalo to Niagara Falls, and it has been confidently expected that this city would become a shipping port of considerable importance. It has been argued that a canal with locks around the regulating dam would be a benefit to navigation, but this may be questioned, as the time consumed in passing through the locks may be considered a detriment which would more than compensate for the gain in safety over the present channel. One of the most important considerations to a manufacturing industry located upon our lands, is the facility for shipment by water. The water frontage owned by this company has always been considered one of its most valuable assets. Such values would be materially diminished by a regulating device which would not only interfere with the free navigation of the river, but would in addition so affect the existing river currents and levels as to render navigation of the lower Niagara difficult, if not impracticable. We

have already shown that if a regulating dam be constructed, there will be times at which the flow of water will be almost, if not entirely, shut off from the American channel. This would, of course, render shipping on the American side out of the question. While it is true that shipping from Niagara Falls is yet in its infancy, nevertheless the possibilities of the future under the existing conditions are unbounded. There is no logical reason why Niagara Falls should not become a materially larger shipping point than Tonawanda, which is now the largest wholesale lumber port in the world. We would most earnestly protest against the installation of any regulating devices which would prevent the normal development of this city as a shipping point, and thus remove one of the principal attractions to factories seeking a suitable site.

It has been stated that should the level of Lake Erie be maintained at a point three feet above the existing normal level the water of Lake Huron and Lake Michigan would be raised one foot. If such is the case it would appear that a large additional quantity of water would thus be diverted through the Chicago Drainage canal to the Mississippi basin. The effect of such loss of water would be to still further decrease the flow in the Niagara river and to reduce to a still lower elevation the low water flow at times when the regulating gates were closed and wind and ice conditions most unfavourable. The loss of the water thus diverted from the St. Lawrence basin would be most serious, and would affect not only the interests of The Niagara Falls Power Company, and other interests at Niagara Falls, but would prove injurious to all shipping interests throughout the St. Lawrence basin. While it may be true that the Drainage canal is provided with facilities which would enable them to regulate the flow to its present proportions, yet it would seem most unlikely, in view of the power development now being made at Lockport, Ill., that any effort would be made to thus reduce the quantity of water available for its operation, as such additional supply would have a high commercial value. The effect of raising the levels of these immense lakes should be most carefully considered, as there may be other streams through which water might be diverted from the St. Lawrence basin by the proposed increase in normal elevations.

Brief No. 4a submitted by Mr. F. L. Lovelace on behalf of the Canadian Niagara Power Co. at the public hearing of September 14, 1905.

To the Honourable the International Waterways Commission.

Gentlemen,—Understanding that your honourable commission has been instructed to investigate the advisability of establishing at the foot of Lake Erie a regulating dam which shall maintain the waters of that lake at a given elevation above that which now normally prevails, we, the Canadian Niagara Power Company, hereby desire to protest against the erection of such regulating device as being opposed to the vested interests of this company. In order that you may the more clearly understand our reasons for opposing the construction of the above mentioned regulating devices, we beg to call your attention to the following brief description of the installation made by this company.

The Canadian Niagara Power Company is a company organized under the laws of the province of Ontario for the purpose of the generation and sale of electric power generated hydraulically. Its plants is located in Queen Victoria Niagara Falls Park at a point approximately 550 feet above the crest of the Horseshoe Falls, such plant being built upon Crown lands. This company having obtained from the province of Ontario certain rights for the development of hydro-electric power, it was the first to place its plant in commercial operation on the Canadian side, and has been producing power since January 1, 1905. The present installation consists of three 10,000 H. P. units, while two additional units of the same size are now being installed. These units are

supplied with water through a canal leading to the Niagara river and having a clear width of approximately 250 ft. The general plan of development is quite similar to that of the Niagara Falls Power Company upon the American side of the river. The water passed from the canal to the turbines and after there generating the desired power is discharged through a tunnel to a point below the Falls. The wheelpit, canal and tunnel are designed for the ultimate installation of six additional units, so that the plant will have a final capacity of 110,000 E. H. P. The plant represents an investment of several million dollars, and this company has acquired by purchase a large amount of land along and contiguous to the Niagara river for the purpose of furnishing suitable points for manufacturing industries, especially those requiring shipping facilities. During your visit here you have seen the general form of construction adopted by this company, the permanent character of its buildings, and the expensive type of our machinery. It may be of interest to note that the 10,000 E. H. P. generators you have seen in our power house are the largest dynamos now operated commercially by hydraulic power. The electricity produced by our plant is used for public and private lighting, railways and other public utilities, as well as for supplying manufactories requiring electric power in their several processes. The plant is connected with that of The Niagara Falls Power Company by suitable cables, and a considerable portion of the current now being generated is supplied to the important industries upon the American shore. The importance of furnishing continuous service from this plant is, therefore, evident, as any interruption in service would seriously affect large numbers of the inhabitants of the Niagara frontier. It is important to note that the current from this plant will also be sent to Buffalo and there delivered for supplying the public utilities of that city, as well as its manufacturing plants. The electric current can now be sent directly over the transmission lines of the Niagara Falls Power Company and will be transmitted to Buffalo upon the Canadian side of the river over a line now in process of construction. By a system of cross-connecting cables and switches the current from this power house can also be used to supply the numerous tenants of The Niagara Falls Power Company located upon their lands, and in fact sent to all of the industries which derive their motive power from The Niagara Falls Power Company's plant. Current from the plant of the Niagara Falls Power Company can, on the other hand, be transmitted to our power house and used to supply tenants upon the Canadian side. The large expenditure made for the purpose of cross-connecting these two great power plants is a striking illlustration of the fact that both companies realize the necessity of furnishing to their customers and to the public a continuous supply of current. It further indicates the great loss and damage which would be inflicted upon the Canadian Niagara Power Company should any change be made in the hydraulics of the Niagara river, which would affect even temporarily such a continuous supply of electric current. All of the arguments adduced against any interruption of service by change in the conditions of the river apply equally well to the plant of the Canadian Niagara Power Company as to that of The Niagara Falls Power Company, for, as above mentioned, the same public utilities are supplied from both plants and the manufactories on the American side are safeguarded by the plant of the Canadian Niagara Power Company. It is further anticipated that a large number of manufacturing plants will locate in the vicinity of Niagara Falls on the Canadian side and will depend upon our plant for their operation.

A careful study of the hydraulics of the Niagara river makes it clear that the detrimental effects of a regulating dam at the foot of Lake Erie would be experienced by power plants on the Canadian side of the river as well as by those now established upon the American side. In order that we may not consume

an unnecessary amount of your valuable time in the repetition of arguments against the establishment of a regulating dam as viewed from the standpoint of this company, we would respectfully refer you to the brief submitted to you by The Niagara Falls Power Company. The arguments therein advanced are applicable to the plant of this company, designed, as it is to meet the existing hydraulic conditions.

We would further emphasize the fact that a regulating dam would be even more detrimental to the shipping interests on the Canadian shore than to those on the American shore, especially if no provision be made for the locking of vessels on the Canadian side of the river. At the present time the Canadian channel affords most excellent facilities for shipping interests, the depth of water at all points being sufficient for vessels of large draught. As the owner of a considerable tract of river shore and of the riparian rights inherent thereto, we would respectfully protest against the introduction of any obstacle to the free navigation of the Niagara river, believing, as we do, that the future of the Canadian commercial development along the Niagara river will depend very largely upon the free and uninterrupted use of the waters of this stream for navigation. The existing conditions are peculiarly favourable in affording excellent shipping facilities to and from the lands of this company, and we would deem it most harmful to our interests to construct the regulating devices which have been suggested.

Brief No. 5, submitted by Mr. Schoellkopf, representing The Niagara Falls Hydraulic Power and Manufacturing Co., at the Public Hearing of September 14, 1905.

Gentlemen of the International Waterways Commission.

Accepting the kindness of your commission, extended through Mr. L. C. Sabin, secretary of the American Section, I have taken this opportunity to present to you my views upon the proposition of the construction of a dam at the outlet of Lake Erie, the purpose of this dam being to improve the conditions of navigation in Lake Erie, in that it would produce deep waterways for commerce by raising the level of the lake, and possibly accomplish that result at a somewhat less cost than it would be required to produce the same depth of water by dredging.

I represent before you to-day, as secretary and treasurer, the Niagara Falls Hydraulic Power and Manufacturing Company. The oldest power company developing power for distribution at Niagara Falls. Jacob F. Schoellkopf, my father, as president of this same company was the first man to place the power development of these Niagara Falls upon commercial basis, and to start many of the great productive industries, upon which the early business life and success of this prosperous city were based. I have personally watched the development of this whole city, depending as it has, and still does, upon the great power producing investments of the development company.

In the case of the Niagara Falls Hydraulic Power and Manufacturing Company the moneys invested by itself, and the companies depending upon it for power, amount at present, to some ten million dollars, with many more millions already projected. This is entirely outside of the large general investments throughout the city in homes and business projects, the values of which fluctuate directly with the success or failure of the power producing interests.

I wish to most vigorously protest as a citizen of this city representing Banking, Hotel, Paper and Pulp Making, Flour Milling, Brewing, Real Estate and other commercial interests, and also as the representative of the oldest power company, against any project such as the construction of a dam in the

Niagara river for regulating the flow of the same, operated in the interests of the navigation of Lake Erie, and against the interests of Niagara Falls. It may readily be seen that such construction would actually cause financial losses to the interests of Niagara Falls, far in excess of the possible saving to the Lake Erie interests, made possible by the construction of a dam, over the amount required to deepen the harbours by dredging. The accomplishment of the desired improvement by either method would work no injury to the Lake Erie interests.

And further, if the power interests at this place were depreciated the development of this section of the state, and especially this city, would be retarded, and all business interests injured. All the great financial investments already made in Niagara Falls, and vicinity, have been made in good faith, and depending upon the continuation of the present conditions surrounding the power development. It would therefore not seem right to sacrifice the present interests and the investments already made in Niagara Falls, and vicinity, to proposed interests of Lake Erie. While the same ends could be accomplished by other means not injurious to Niagara Falls.

I have been actively engaged for the past 27 years in the management of this company and I am familiar with the extreme difficulties experienced by our engineers in dealing with problems involved in procuring the continuous power, demanded by our industries, under present conditions existing in the Niagara river. If these conditions were made more rigorous, as our engineers assure me they would, if any further obstructions were placed in the Niagara river, we would then be unable to meet the demands of our customers, as at present, which would cause great financial loss, both to ourselves and them, and in some cases would mean utter ruin.

To remove any possible impression made upon your minds by the nature of current reports that the Power Companies in this city are actuated only by selfish motives, and that they propose to obtain their own advancements at the sacrifice of the beauty of Niagara Falls, I would say that I have always had at heart the preservation and enhancement of the beauty of this natural wonder, and that the company which I represent, and its officers, always worked in perfect harmony with the New York State Park Reservation Commissioners, who are our near neighbours, and it is our desire to continue to co-operate with them in all their efforts to preserve their Falls in all their magnificence and beauty.

I would, therefore, ask that most earnest and careful consideration of these facts, by your commission, and I feel certain that upon a full knowledge of the same, and in justice to yourselves, and to the interests for which you have so kindly allowed me to speak, you will see fit to recommend to your respective Governments, that no obstructions be placed in the Niagara river that may be injurious to these interests.

To assist you in your further study of this matter I have instructed our engineer to prepare and present to you any data which would be necessary for a full understanding of our conditions of development and operation.

And I would say that any information in addition to that presented, and which we would be able to give, will be gladly furnished upon your request.

Presented by

A. SCHOELLKOPF,

Sec. & Treas. of the Niagara Falls Hydraulic Power and Manufacturing Co.

September 14th, 1905.

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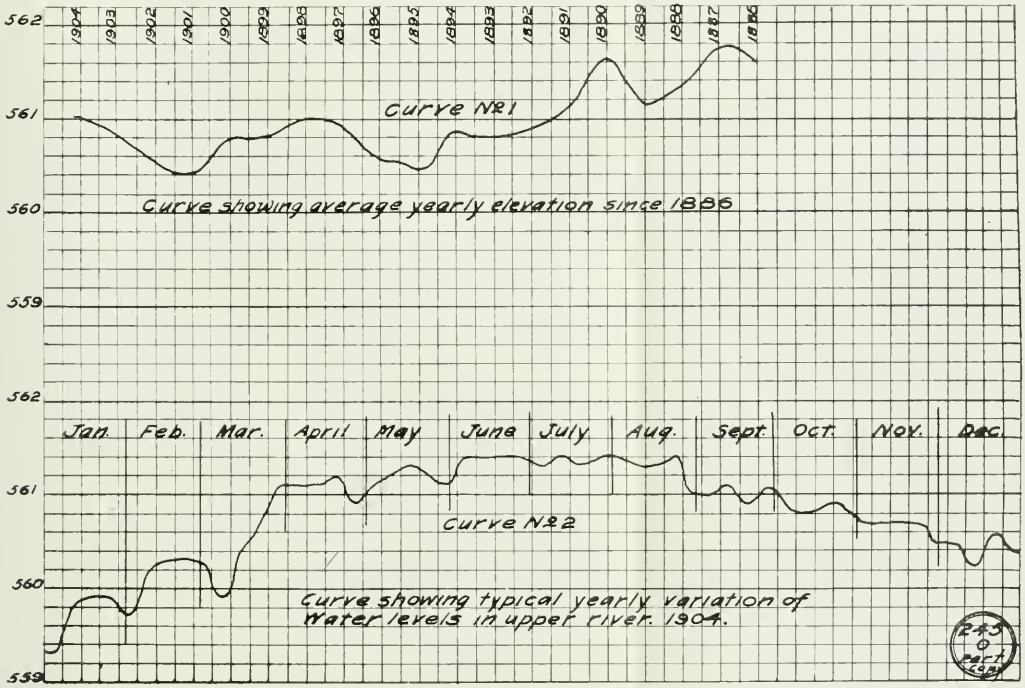
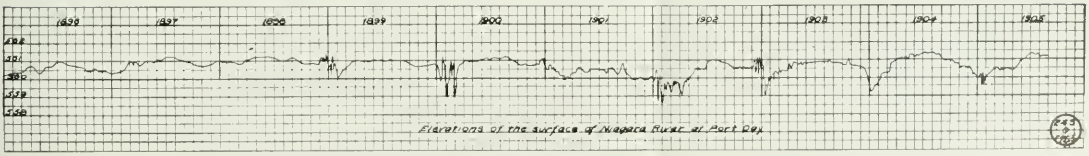
Photo 585—Showing generally the plant and its dependent industries, of the Niagara Falls Hydraulic Power and Manufacturing Co., at Niagara Falls, N. Y.

CURVE No. 1. Taken from the records of the Niagara Falls Hydraulic Power and Manufacturing Company, from the year 1896 to 1904 inclusive, showing the yearly elevation of the water in Niagara River at this Company's intake.



CURVE No. 2. Taken from the records of the Niagara Falls Hydraulic Power and Manufacturing Company, showing the variation of water levels in Upper Niagara River in 1904.



SERIES of yearly curves, from 1896 to 1905, taken from the records of the Niagara Falls Hydraulic Power and Manufacturing Company, showing elevations of the surface of Niagara River at Port Day.

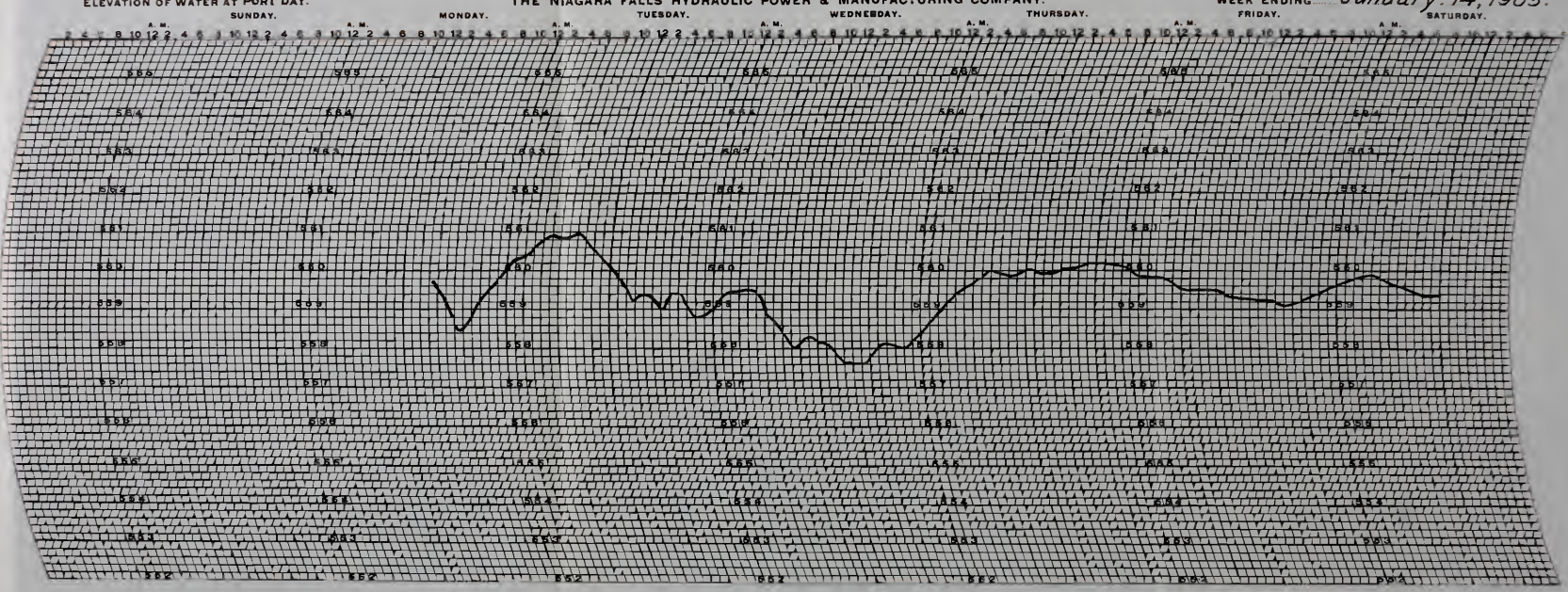
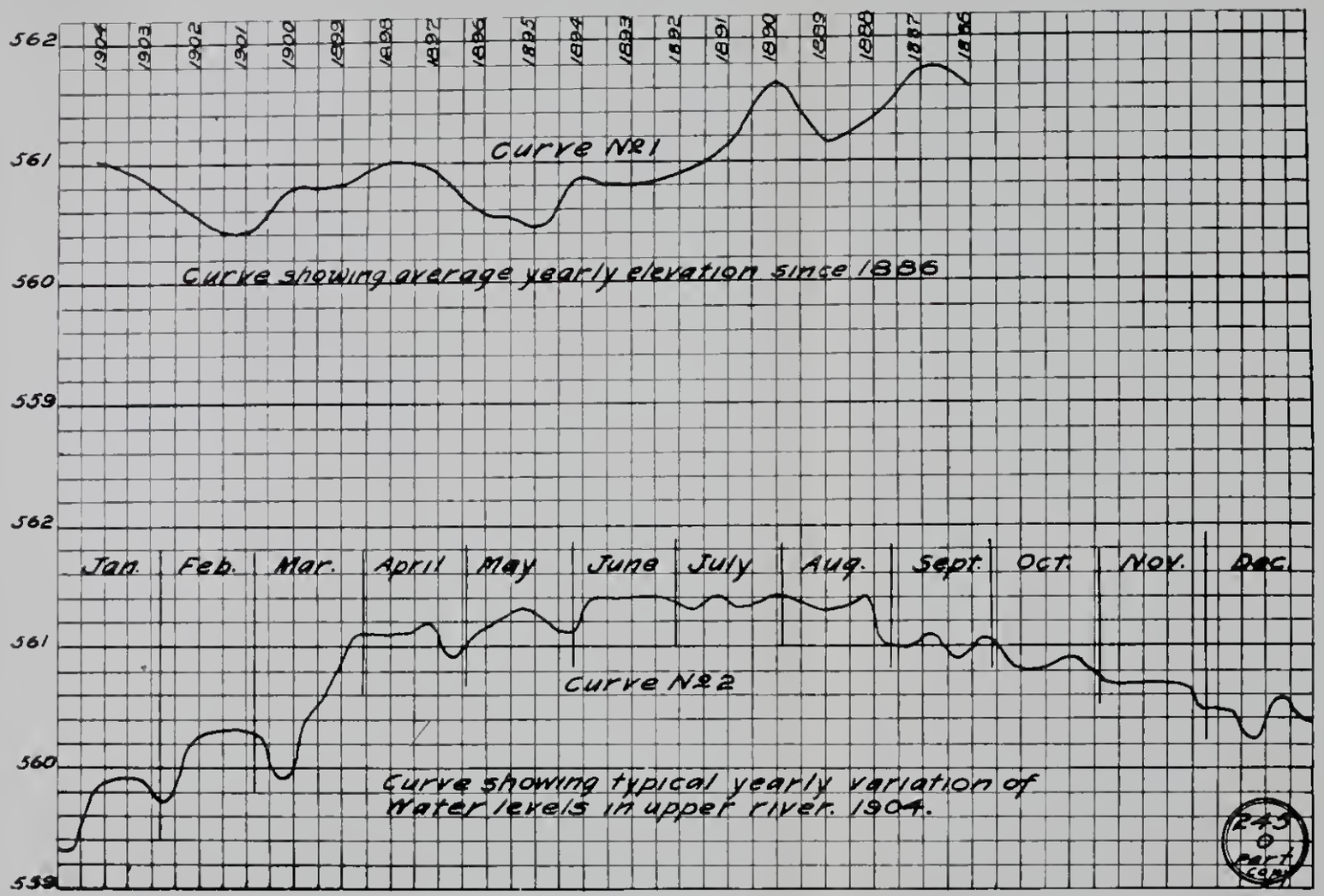


Chart taken from the recording gauge of the Niagara Falls Hydraulic Power & Manufacturing Company, located in Niagara River near the intake of said Company, which shows the actual variations of elevation of water for one week, from January 8 to January 14, 1905.

CURVE No. 1. Taken from the records of the Niagara Falls Hydraulic Power and Manufacturing Company, from the year 1896 to 1904 inclusive, showing the yearly elevation of the water in Niagara River at this Company's intake.



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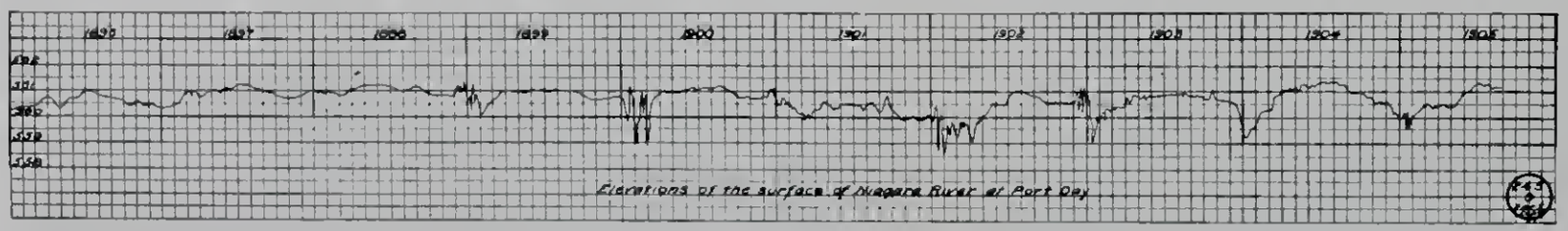


SERIES of yearly curves, from 1896 to 1905, taken from the records of the Niagara Falls Hydraulic Power and Manufacturing Company, showing elevations of the surface of Niagara River at Port Day.

SESSIONAL PAPER No. 19a

BRIEF No. 6, submitted by Mr. Schoellkopf, representing the Niagara Falls Hydraulic Power and Manufacturing Co. said brief being data prepared by John L. Harper, Esq., Chief Engineer of the Company.

TO THE INTERNATIONAL WATERWAYS COMMISSION.

GENTLEMEN:—We are in receipt of communication from Mr. L. C. Sabin, secretary of the American Section, outlining the duties of your commission, copy of which we hereto attach.

The Niagara Falls Hydraulic Power and Manufacturing Company, a corporation of the State of New York, engaged in the development, and sale, of power derived from the waters of the Niagara river, under act of the State of New York, May 28, 1896, hereby desire to present to your commission certain facts, and to explain to you certain conditions existing in connection with the flowage of water in Niagara river, and to indicate to you how any interference, or change, in the flowage of this river will affect the business and rights of this company.

PLAN OF DEVELOPMENT.

The plan of development of this company is to take water from the Niagara river, above the Falls and Rapids, and by means of a canal bring it to the edge of the high bank below the Falls. From there it flows through penstocks to turbines, in and at the foot of the cliff, where its power is applied either directly, or by means of transmission, to the industries using the same. Photo No. 585, hereto attached give an idea of this development, and its dependent industries, representing some 40,000 horse power at this date.

PHYSICAL CONDITIONS OF THE NIAGARA RIVER.

The outflow of the Niagara river taken from a table compiled by the Board of Engineers on Deep Waterways, during 1897-1898, shows the mean flow of this river from 1865-1898 to be approximately 220,000 cubic feet per second. This table also shows the maximum outflow of 242,000 cubic feet per second during year 1882, and minimum of 187,000 cubic feet per second during 1895. It is a fact that the volume of flow of water in the river is the largest factor determining the elevation of the water along the course of this river. We, herewith, present a curve, marked No. 1, from the records of this company from the year 1886 to 1904, inclusive, showing the yearly elevation of the water in Niagara river at this company's intake. Reference to this curve readily shows that there is a decided fluctuation in the flowage of the Niagara river from year to year. We also present a curve, marked No. 2, showing the variation of these same elevations during the term of one year, and for which we have chosen the records of 1904, which is a typical yearly curve, as may be seen by comparing with a series of yearly curves, a copy of which we also attach. Further, to more definitely show the variation of these elevations I have attached hereto a copy of a chart taken from our recording gauge located in Niagara river near the intake of this company, which shows the actual variations for one week, from January 8 to January 14, 1905.

These curves, showing fluctuations and variations of the river, are presented for the purpose of indicating the change of elevation and consequent changed in flowage of water in Niagara river in the vicinity of our intake, and with which this Power Company has to contend in their work of procuring water for power development at present.

We also present an approximate outline of the cross section of Niagara river at the intake of this company, and we wish to call your attention to the fact that on the American side of Niagara river, near our intake, the water is generally shallow, growing deeper on the Canadian side, where the flow is greater, and that any obstruction placed in the river which would tend to further decrease the minimum amount of flowage in the river, and would very materially affect the ability of this company to secure the water necessary at their intake for the development of power, and besides, detract very materially from the amount of water passing over the Falls, and especially the American Fall, in case of low water.

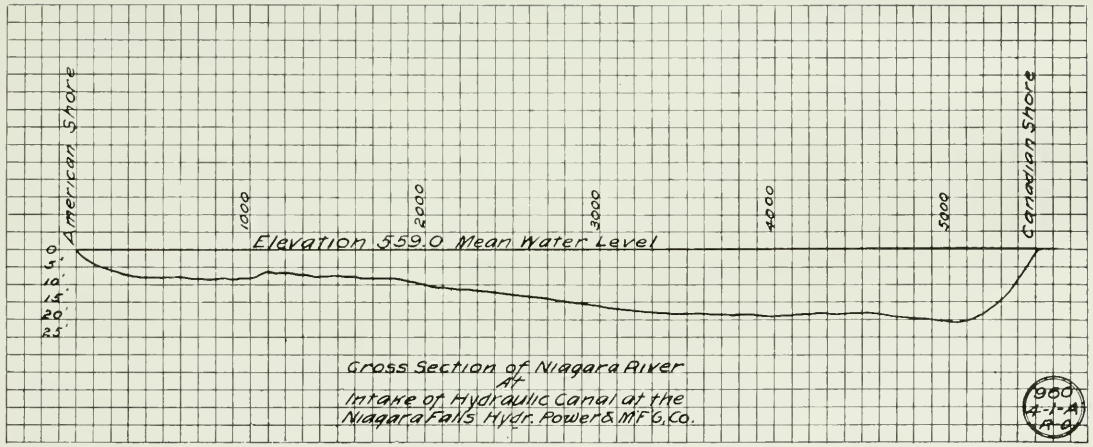
For this company to perform the necessary deepening of the river bed from their present intake to the section of the river in which the deeper channels are located would necessitate great financial expense and would not remove the possibility of entire or partial stoppage of their water supply.

Referring again to the curves showing fluctuations of elevations it may readily be seen that these variations depend upon different causes, first upon the actual level of Lake Erie, which increases or decreases the mean outflow of the river, which is shown to vary from year to year. This variation is due mainly to the amount of evaporation and rainfall in the water shed of the system of Great Lakes, and extending over a term of years. The curves representing the fluctuations during one year are affected by other causes such as the obstruction of the rivers connecting the system of Great Lakes by ice, and the direction, force and duration of the wind, especially over the area of Lake Erie. In the case of the weekly record taken from our recording gauge, the fluctuations shown on this are undoubtedly due almost entirely to obstructions in the river, and to the wind.

Considering these causes it may be seen that conditions undoubtedly have existed and are liable to be met with at any time in which the detrimental effects of all of these causes may be superimposed upon each other, and at such times the actual outflow of water in the river may be reduced to only a fraction of the mean flow.

This company has found that the problems connected with the formation of ice, in its many forms, in the waters of Lake Erie and the Niagara river are the greatest with which they have to contend, causing such difficulties, and effects of such nature, that it is impossible to definitely develop in advance plans or methods satisfactorily dealing with the same. At the beginning of each winter the surface of Lake Erie is frozen, and the winds keeping the surface of the lake in motion before the ice is of sufficient strength to withstand its action, it becomes broken into small cakes and ground into slush ice which lies upon the surface of the lake, as a loose shifting mass.

Due to the suction of the outflow into the river, and also to southwest winds upon the lake tending to drive this ice into the outlet, great masses of this loose ice are forced into Niagara river running many feet deep in the narrow parts of this river at the outlet of Lake Erie. This amount of ice may be somewhat increased during the flow down the river. It is not an unusual sight to see the river in front of this company's intake above the Falls, covered practically from side to side with surging masses of this flowing ice, and if, due to the shifting of the wind, the elevation of the water in the river is lowered by the blowing back of the water in this lake away from the entrance of the river, this ice is liable to become clogged upon the shallow bottom, reefs and rocks in the course of the river and to be forced up on such lodgments in great masses, and other ice buildings upon these lodgments soon practically shut off the deeper courses between the obstructions. This effect many times extends over a large part of the bed of the river in front of the intake of this company. I present herewith photographs showing these conditions, as they have existed in front



APPROXIMATE outline of the cross section of Niagara River at the intake of the Niagara Falls Hydraulic Power and Manufacturing Company.

PHOTO No. 331.—Showing, during the month of February, 1899, a field of crushed ice lodged in front of the intake of the Niagara Falls Hydraulic Power and Manufacturing Co. at Niagara Falls, N.Y.

Photo No. 340.—Showing the difficulty encountered in the month of February, 1893, by the Niagara Falls Hydraulic Power and Manufacturing Co. in getting water into their intake through the masses of lodged ice.

Photo No. 430.—Showing the ice field at Niagara Falls during the winter 1903 and 1904. This ice field is blocking the intake of the Niagara Falls Hydraulic Power and Manufacturing Co.

PHOTO No. 347.—Showing in May, 1899, the ice flowing directly past the intake of the Niagara Falls Hydraulic Power and Manufacturing Co.

PHOTO No. 404.—Showing the ice flowing directly past the intake of the Niagara Falls Hydraulic Power and Manufacturing Co., in March, 1903.

19a—8c 1913

Photo No. 434-5—Showing the conditions existing during the winter of 1903 and 1904 at Niagara Falls, in the vicinity of the intake of the Niagara Falls Hydraulic Power and Manufacturing Co.

19a—8d 1913

Photo No. 552-3—Showing similar conditions existing during the winters of 1904 and 1905.

19a—8g. 1913

PHOTO No. 557-S—Showing during the winter of 1905 small channels created by blasting and breaking up the ice by means of dynamite, to secure water at the intake of the Niagara Falls Hydraulic Power and Manufacturing Co.

of our intake, which photographs are explained in detail as follows:—Photo No. 331, taken February 6, 1899, shows an immense field of this crushed ice lodged in front of our intake, and Photo No. 340, taken on the same date, shows the difficulty then encountered in getting water into the intake through the masses of lodged ice. These two photos are shown for the purpose of proving that this stoppage of ice existed before any large amount of water was taken by any of the power companies.

The past two winters have been of greater severity than any experienced for some time and consequently we have experienced greater fluctuations of the water at our intake, due to the greater obstruction of the river by ice. Photos No. 434 and No. 435 show the conditions existing during the winter of 1903 and 1904. The immense masses of ice lodged on the reefs and natural bottom of the river may be readily seen. A closer view taken of the ice field itself is also shown in Photo No. 430. Photos No. 552 and No. 553 show similar conditions existing during the winters of 1904 and 1905. Photos No. 557 and No. 558 indicate the measures necessary to again secure water at our intake, which was done by blasting and breaking up the ice by means of dynamite. These small channels, however, were in constant danger of becoming clogged by more ice flows and low water in the river. Photo No. 347, taken May 1899, and Photo No. 404, taken March 1903, show that immense flows of ice, not accompanied by extremely low water, flow directly past the intake of this company without causing any stoppage or trouble.

It has also been found by experience that any obstruction, such as piers, booms or gates, placed in the river, during the season in which ice is flowing, collect upon themselves masses of ice, and that without prompt and efficient clearing by blasting, and breaking up by means of tugs, the ice will bridge across distances of 100 feet, and over, from one pier to another and shut off all the waterways between them.

We also wish to say that in our estimation it will be impossible to build any form of a regulating dam at the outlet of Lake Erie that will not increase the fluctuations of the flowage of water in Niagara river, both in the case of lowering of water at this end of the lake, due to the wind effect, but also to the fact that such dam would form obstructions to the flowage of the masses of ice during the winter season and that it would clog upon a dam built in the form of a submerged weir, especially in the case of low water, and that it would build upon and shut off the waterways between any such structure as would be required for regulating gates.

Also that in dealing with the flowage of ice in the Niagara river the mean flowage of water for a year, or month, is of little importance compared with the great temporary fluctuations due to the causes above mentioned.

It is a matter of record and general knowledge that during the year 1848 an ice dam actually occurred at the outlet of Lake Erie, and that the water was entirely shut out from the Niagara river for a period of such duration that the Falls ran dry, and that parties were able to drive out upon the rocks forming the natural bed of the river and also that at many times since partial stoppages have occurred during the winter seasons, decreasing the flow of water to a very small amount, and that in our judgment a dam or regulating structure at the outlet of Lake Erie would increase the possibility of entire or partial stoppage of these waters.

We would further call your attention to the nature of all the Electro-Chemical processes depending upon this power system, in that a temporary diminution or suspensions of their power renders them very inefficient, if not suspending their work entirely, and that if, for any reason, the reliability of their power was decreased at least a part of these Electro-Chemical processes would become complete failures. Many of these companies have located here for the reason

that the Niagara river could be depended upon for giving more continuous power than they could obtain from any other source.

SUMMARY.

We have shown,

First:—From the actual records of this company there are now fluctuations in the flowage of water in the Niagara river, resulting from certain natural causes.

Second:—That the development of this company is based upon the conditions as they exist at present.

Third:—That the effect upon the business of this company by the increase of the fluctuations of this water outflow from Lake Erie would depreciate the value of their rights, and injure the business of this company, as well as the other companies depending upon them for power.

Fourth:—That the dealing with the flowage of ice in the Niagara river is the most serious problem to be encountered in the continuous power development, and that in the past we have at least one instance of the complete obstruction of the Niagara river at the outlet of Lake Erie by ice, as well as many instances of partial stoppage.

Fifth:—That this company objects to the construction of any structures whatsoever in the Niagara river that would increase the fluctuations of the outflow of Lake Erie, or increase the possibility of the choking of the river by ice.

Respectfully submitted,

The Niagara Falls Hydraulic Power & Manufacturing Co.,

by JOHN L. HARPER,
Chief Engineer.

Brief No. 7, submitted by Mr. Beverly R. Value, representing the Electrical Development Co. of Ontario at the Public Hearing of September 14, 1905.

Electrical Development Company of Ontario, Limited.

Construction Department,
Niagara Falls, Ont.

Niagara Falls, September 14, 1905.
Ontario.

The International Waterways Commission,
Meeting at Niagara Falls, N.Y., September 14, 1905.

Gentlemen:—I beg to submit in behalf of the Electrical Development Company of Ontario, Limited, certain points showing that the interests and success of this company will be materially affected by the construction of works across the outlet of Lake Erie for the purpose of raising and regulating the surface of the lake.

The Electrical Development Company of Ontario, Limited, is incorporated under the Companies Act of the province of Ontario by Letters Patent bearing date the 18th day of February, 1903, and is the holder of the franchise from the Commissioners of the Queen Victoria Niagara Falls Park to enable it to develop from the waters of the Niagara river 125,000 Electrical Horse power, which

franchise has been confirmed by a special Act passed at the last session of the Legislature of the province of Ontario, 2 Edward VII, Chapter 12.

The said franchise was granted on the 29th January, 1903, and thereupon the company floated its bonds and issued its capital stock to the amount of several million dollars. The whole of the said bonds and stocks have been fully subscribed and paid for. The whole of the moneys realized for the sale of the said bonds and stock is being used in the construction of the hydro-electrical works of this company.

These works are situated on the Canadian shore at Tempest Point in Queen Victoria Niagara Falls Park one-half mile above the Horse-shoe Falls. They will generate the full 125,000 horse-power, which power will be used for extensive manufacturing and other industries lying throughout the territory between Niagara Falls and Toronto. The development of this power will require approximately 11,200 cubic feet of water per second. A sufficient supply of water, with fluctuations inside the limits for which this plant was designed and is being built, is essential to its successful operation. The failure of its power, even though for a short time, would result in a great loss both to this company and also to the many and important interests depending upon it for power.

The general scheme of this development, the construction of which is nearing completion, is as follows:

The water from the forebay is passed through steel penstocks to turbines located at the bottom of the pit and then discharging through a deep tail race tunnel to the gorge below the Falls. For the proper control of the water entering the penstocks, extensive headworks are necessary. Briefly, they consist of a gathering dam or submerged weir extending from the lower end of the wheel pit up stream a distance of about seven hundred feet and lying at an angle of thirty degrees with the shore of the river. The upper end of this dam is about three hundred feet from the shore line. The primary function of this structure is to raise the level of the water on the head-gates, providing additional head and affording a means of controlling ice and any debris which may enter the outer forebay. The head-works are protected by two lines of submerged arches, extending the full length of the wheel pit and forming two distinct forebays, each controlled by a separate spill-way. The inner forebay, which is enclosed by the power house superstructure, is further provided with steel racks for the further screening of the water. In the design of these headworks, the most careful study was made of the flow and fluctuations of the river up to that time and the works are prepared to take care of both maximum and minimum fluctuations. Any changes in the conditions increasing these fluctuations either way would necessarily impair the output and value of the plant.

A consideration of the general proposition of a dam across the outlet of Lake Erie would show as a self evident fact that the construction of the regulating works must injuriously affect the regularity of flow of the water. When the water in the lake is high, the river would naturally be high also and, in order to keep the level of the lake uniform, it would be necessary to open the gates, thus discharging an additional amount of water in the river, producing excessive flood conditions. On the other hand, at time of low water in the lake, the gates would have to be closed to keep its level up, thus producing excessive low water in the river.

As pointed out in a report of Mr. James Wilson to the Commissioners of the Queen Victoria Niagara Falls Park, dated August 24, 1905, in whose deductions and facts I fully concur, should a time of extreme low water (due to winds) in the lake occur and at the same time the gates be closed, the river would practically run dry, only a little water flowing in the deepest channels. This water would, in addition to being inadequate in quantity, be inaccessible for power purposes. Under the present conditions, during low water in the

winter and early spring, many reefs of ice are formed at times completely closing the American Falls. The ice problem has necessitated the building of extensive and costly headworks in an effort to, as far as possible, minimize the ill effects of this floating ice upon the output of the plant. With low water in the lake, even though with the gates open, no human ingenuity and the further expenditure of no amount of capital would enable the ice to be taken care of and the plant run at anything but disastrous reduction of output. A certain amount of surplus water, which is provided for in our design, is necessary to run off the floating ice.

I cannot protest too strongly for my company against the construction of the proposed works.

Very truly yours,

BEVERLY R. VALUE,
Chief Eng. of Construction.

BRIEF No. 8, submitted by Mr. A. W. Gray, representing the Harbour Commissioners of Niagara Falls, N.Y., at the Public Hearing of September 14, 1905.

FACTS touching the importance of the Niagara river as a highway for commerce.

Outside of the facts, which show the importance of maintaining a deep water-way as far as North Tonawanda in the Niagara river, the following facts are presented with a view to showing the importance of opening the Niagara river to vessels of deep draught as far down as Schlosser Landing, which is two miles above the falls.

There is at present a channel in the Niagara river as far as Buckhorn island, with a depth of water for the most part of from seventeen to twenty-four feet; from Buckhorn island to Schlosser from thirteen to seventeen feet, Buckhorn island being at present the end of navigation for anything excepting the smallest lake craft.

During the year ending June 30, 1905, the total number of vessels entering this port from foreign ports was 851;

The total clearances for foreign ports was.....	829
The total entrances from domestic ports was.....	629
The total clearances for domestic ports was.....	724

The tonnage of the average vessel coming down the Niagara river, as far as Buckhorn island, is from six to ten hundred tons gross.

The principal commodity coming by water to Niagara Falls is pulp wood, which is put into rafts at Buckhorn island and towed down the river to the International Paper Company's mills.

There are upwards of fifty corporations, exclusive of power companies, located in the city of Niagara Falls, engaged in the manufacturing business, representing a total investment of over forty million dollars.

The value of exports by rail and water from this district which includes North Tonawanda, to Canadian ports is, $14,588,760.

The value of imports by rail and water from Canadian ports to this district, is, $3,160,345.

Through business by rail,—650,000 cars of freight.

Local business—cars loaded and unloaded at Niagara Falls, over 50,000.

The principal raw materials consumed in factories here are

Wheat,	Iron,
Lime,	Pulp wood,
Salt,	Ground wood.
Coke,	

Schoellkopf & Matthews Mill, Central Mill and the Natural Food Company together, use upwards of three million bushels of wheat a year which is, for the most part shipped from the west.

The Acker Process Company, Union Carbide Company, Castner Electrolytic Alkali Company and the National Electrolytic Company consume upwards of 45,000 tons of lime a year.

The Acker Process Company, Castner and a few small consumers, use upwards of 35,000 tons of salt a year.

The International Paper Company, Cliff Paper Co., and Pettebond Cataract Paper Company use upwards of 60,000 cords of pulp wood a year, in addition to upwards of 15,000 tons of ground wood that is shipped here and used in the manufacture of paper.

Various ores are brought in for the Pittsburg Reduction Company, Oldbury Chemical Company, Norton Emery Wheel Co., and a large number of other concerns, the average tonnage of which runs into upwards of 100,000 tons a year.

Post Office Revenues for year ending March, 1901, $37,140.99.

Same for year ending June 30, 1905, $72,592.74.

APPENDIX 'Sf.'

PUBLIC hearing held by the International Waterways Commission in Toronto, September 15, 1905.

CITY HALL,

TORONTO, Friday, Sept. 15, 1905.

The Commission met at 11 o'clock a.m. in Committee Room No. 1, City Hall, Toronto.

Present: J. P. Mabee, Esq., K.C., Chairman of Canadian Section; Dr. W. F. King and Louis Coste, Esq., members of the Canadian Section; Thomas Coté, Esq., Secretary Canadian Section; Col. O. H. Ernst, Chairman of American Section; Louis C. Sabin, Esq., Secretary of American Section; George Clinton, Esq., member of American Section.

The interests of the city of Toronto were represented by the following gentlemen:—Alderman Spence (Acting Mayor in the absence of His Worship Mayor Urquhart), Alderman Hubbard, Peleg Howland, Esq., First Vice-President Board of Trade; J. F. Ellis, Esq., Second Vice-President Board of Trade; F. G. Morley, Esq., Secretary Board of Trade; Harbourmaster Postlethwaite, Noel Marshall, Esq., member Board of Trade; C. H. Rust. Esq., City Engineer; R. C. Steele, Esq., member Board of Trade.

J. P. MABEE, Esq., K.C., Chairman of Canadian Section, took the chair and opened the meeting. He said: You are all of you probably aware that in 1902 the Congress of the United States passed an Act of which this is one of the sections, and of which the portions that I will read are the material

ones in so far as the particular matters in question are concerned:—'That the President of the United States is hereby requested to invite the Government of Great Britain to join in the formation of an International Commission to be composed of three members from the United States and three who shall represent the interests of the Dominion of Canada, whose duty it shall be to investigate and report upon the conditions and uses of the waters adjacent to the boundary line between the United States and Canada, including all of the waters of the lakes and rivers whose natural outlet is by the River St. Lawrence to the Atlantic ocean; also upon the maintenance and regulation of suitable levels; and also upon the effect upon the shores of those waters and the structures thereon, and upon the interests of navigation by reason of the diversion of those waters or change in their natural flow; and further to report upon the necessary measures to regulate such diversion, and to make such recommendations for improvements and regulations as shall best subserve the interests of navigation in the said waters. The said Commissioners shall report upon the advisability of locating a dam at the outlet to Lake Erie with a view to determine whether such dam will benefit navigation; and if such structure is deemed advisable shall make recommendations to their respective governments looking to an agreement or treaty which shall provide for the construction of the same, and they shall make an estimate of the probable cost thereof.' The rest of the section deals with matters of detail in connection with the personnel of the commission. In pursuance of that invitation, the Government of Great Britain referred the matter to the Canadian Government, and after certain negotiations the invitation was accepted and the result was that the present commission came into existence. You will observe that this commission has no final powers at all. It is merely a commission for the purpose of collecting information. You will notice that the words are that we are to report to our respective Governments; and if we are able to make a report that might be embodied in some treaty or agreement, or something of that sort, the results of our labours could only be brought about by legislative sanction between the Governments of Canada, Great Britain and the United States. We, then, have simply been endeavouring to collect all such information that is available from original sources, in order that we might put this information upon record, digest it, and give it the consideration necessary to carry out, if we are able to, the objects of this Act. The commission, as you probably have noticed in the papers, have met at a number of towns and cities in the United States and Canada, and so far we have acquired a vast amount of information, and which is part of the records of the commission. I would ask Controller Spence, the Acting Mayor, and also Chairman of the Board of Harbour Commissioners, to give the commission such information as he may have bearing upon the matters that we have come to inquire about.

Acting Mayor Spence—Mr. Chairman, may I say first that on behalf of His Worship the Mayor, who is absent, and the City Council, the representatives of the city who are here would like to give you a very cordial welcome, and express their desire to be of any service that they can be in the carrying on of the inquiry that you are charged with. In regard to the particular subject that you are charged with investigating officially, I have nothing at all to say personally. The Board of Harbour Commissioners, who are looking after the interests of the business of Toronto harbour, are very anxious about the situation in connection with that harbour. We are now so situated that a period of low water is a very serious inconvenience to us. If the particular improvement or construction that you have spoken of would in any way affect the level of the water in Toronto harbour, in any way lower it, then the carrying out of the work would be an incalculable disaster to our city, and we would like to offer to it the strongest opposition. But that is said in absolute ignorance of what the effect of that construction would be. That is a matter to be decided by you with the assistance of expert advisers; we laymen don't know anything at all

about it. Mr. Postlethwaite, our harbourmaster, who is here, knows more about the harbour than anybody else, and he will be ready to give you any information that he is possessed of concerning levels at different times, concerning business done here, and concerning the importance of Toronto harbour, which has, I might say, an international character inasmuch as it is the most important harbour of refuge on Lake Ontario for all the shipping commerce that travels through this way. With regard to finding out all you can, Mr. Chairman, I might say that we are pleased to have arranged for a boat, so that at two o'clock this afternoon, if convenient to the commission, we may not merely be able to tell you what we know, but show you the harbour, that you will understand the situation better yourselves. We would therefore be obliged if the commission would adjourn its work about two o'clock and go to the Bay street wharf, where the 'Island Queen' will be in waiting under direction of our City Engineer, who will point out to you the various features of our harbour, its advantages and difficulties that at present interfere with its operation as extensively as we would like to have it carried on, and from what you see you will probably gather more information than anything that we could tell you.

Chairman MABEE—I am sure, Mr. Spence, the commission will be extremely gratified to visit the harbour on the 'Island Queen'. I would ask Mr. Postlethwaite, the harbourmaster referred to by Mr. Spence, to address the meeting.

COLIN W. POSTLETHWAITE, Esq., Harbourmaster, said—The Chairman of the Harbour Commissioners has not overstated the importance of this harbour. It is, as he says, the only harbour of refuge on Lake Ontario of any importance, and it is essential that the two entrances should be kept open for vessels drawing at least 14 feet of water. As the Chairman said, if this proposition in any way affects the level of Lake Ontario and reduces the level of the harbour, we will oppose it in every shape and form that we can, in the general interests of navigation. The harbour is labouring under a great disadvantage. The freshets down the Don bring an immense quantity of material every year. You will hardly credit it when I state that an eminent engineer has estimated that the quantity of material brought down the Don and deposited on the floor of the harbour each year amounts to an area of five acres of solid material five feet deep —a solid island five feet high, and of an area of five acres. Now, almost all this material has to be dredged out year after year by the Commissioners at a very heavy expense, in order to enable vessels to reach the different coal docks and passenger docks. This has to be done year after year, because every spring these channels are filled up with the debris from the Don. If, in addition to that dredging, the level of the water is lowered, our difficulties will be increased in such proportion, and the resources of the Commissioners will be entirely exhausted long before we can give the 14 feet of water to vessels coming into this harbour. I hope the Commissioners will be very careful before they advise the construction of anything at the mouth of the Niagara river that is likely to affect the level of Lake Ontario. This is an engineering matter, and as I am not an engineer of course I can only base my arguments upon common sense, and when common sense comes in opposition to profession it is generally overlooked. I don't think it is possible to raise the level of Lake Erie without reducing the level of Lake Ontario. Nature has provided an inlet and an outlet; and that inlet and outlet nearly balance each other. It keeps an average depth of water in Lake Ontario. Now, the superficial area of Lake Erie is greater than the superficial area of Lake Ontario; and in order to raise Lake Erie two feet you would lower Lake Ontario by two feet six inches or two feet nine inches, simply because you cut off the inflow, but the outflow is going on all the same all the time. When Lake Ontario is reduced two feet nine inches, and Lake Erie

is raised two feet, then the water will come over the breakwater and the original state of affairs will be resumed. But what would be the result of that? It will merely be to prevent further lowering of Lake Ontario. You cannot possibly hope to raise the level of Lake Ontario, because the same outflow has to balance the same inflow. The water is gone; the water is kept up in Lake Erie; it has disappeared; and the levels of Lake Ontario will be reduced by whatever proportion is required to raise Lake Erie. I think it is a self-evident fact. If you would build a breakwater at Kingston and allow Ontario to refill, of course that could be done, but that would be at the cost of navigation in the St. Lawrence river, and the navigators of the St. Lawrence would never submit to it. I hope you follow my argument.

Chairman MABEE—Yes, sir.

Mr. POSTLETHWAITE—I express myself with some diffidence because I am not an engineer, and I think it is an engineering question; but I think common sense will show that water once taken out of a system, unless it is replaced by a double allowance in the inflow, will never be raised again. I don't see that there is any possibility of raising the level of Ontario when once lowered by this storage up in Lake Erie, because the same outflow goes on all the time.

Mr. COSTE—Have you ever been troubled by high water in Toronto?

Mr. POSTLETHWAITE—That question of high water is a local matter. It is not affected by this breakwater in any way or shape or form. We have had high water here. We have had water 47 inches above our zero mark; that is the highest ever shown; but we have high water here and low water at Lake Superior, and high water in Lake Superior and low water here. Each of the lakes acts independent of the other.

Mr. COSTE—I understand that. I want simply to know from you if you have any damage done on this lake by the fact of high water, either through local causes or otherwise?

Mr. POSTLETHWAITE—Well, of course when the water is high and we have a southwesterly storm, the island naturally suffers more than it would if the water were low.

Mr. COSTE—Suppose that the question were solved by taking away from your lake one foot at high water and giving you an extra foot at low water?

Mr. POSTLETHWAITE—I think that would be a good thing. We dread low water.

Chairman MABEE—It sounds all right, doesn't it?

Mr. POSTLETHWAITE—If you could ensure us from low water for ever, we don't aspire to very high water.

Mr. COSTE—That is just the point I wanted to make. Have you gaugings for a number of years?

Mr. POSTLETHWAITE—For 15 years.

Mr. COSTE—Could you send us a copy of all those things?

Mr. POSTLETHWAITE—Yes.

Chairman MABEE—Perhaps Mr. Postlethwaite has them with him.

Mr. POSTLETHWAITE—I have drawn out a little table here. The highest water ever recorded in the harbour since 1853 or 1854, when the gauge was first established, was in 1870, when we had 47 inches above our zero mark. The lowest water was in 1895, when we had 25 inches below zero, making a difference of 72 inches.

Chairman MABEE—Six feet exactly.

Mr. POSTLETHWAITE—Yes.

Mr. COSTE—If we were to reduce that to three feet you would not object?

Mr. POSTLETHWAITE—Those were very exceptional years. You know the high and low water is attributable not only to the rain and snowfall, but I think more particularly to evaporation. In fair weather the evaporation on this lake is tremendous. Last year we had a dull spring, lots of cloudy weather and very little evaporation, and we had higher water last year than we have had for the last thirteen years. I think the high water is entirely a local matter. It is not affected by the high water in the upper lakes at all. It is affected to a certain extent by the rainfall, but more particularly by evaporation. Now, the average high water in five years is 17 inches above. The average low water in that time is 11 3-5 inches.

Mr. COSTE—Is your gauge referred to the American datum?

Mr. POSTLETHWAITE—No,they are local data established by the commission in 1853 or 1854, which have been sustained ever since. At that time it was supposed to be the lowest point that the water would ever reach; but since then the water has often gone far below the zero mark.

Chairman MABEE—Just a word to correct any possible misunderstanding, and without in any way giving any personal view at all. The proposal or suggestion is not that the mean level of Lake Erie should be raised, but that it should be preserved. The desired work is not to raise Lake Erie one foot or two feet, but to prevent the abnormal low water that occurs there apparently in regular cycles; not to raise high water, but it suggested that some work might be established whereby the extreme high water period might be relieved, and at the same time that the extreme low water period might be prevented. Whether such a thing is possible without affecting the interests below the Niagara river is something that we are not yet in a position to decide, because we have not got the information. I will now ask Mr. Rust, City Engineer, to speak.

C. H. RUST, Esq., City Engineer of Toronto, said—Mr. Chairman and gentlemen; the only matter, I suppose, that affects us is the question of the erection of the dam at the foot of Lake Erie. The Board of Control asked me to look into this matter some time ago, and I reported the other day that before I could report with any authority on the matter a great deal of information would be necessary, such as the rate of flow of the lakes, the difference in the levels, the variations in the levels, and probably the amount of evaporation in question. I do not think that the erection of the dam would affect the level of the lake except during periods of very dry weather, when probably the evaporation would make it difficult. I see by the newspapers that the power companies at Niagara Falls are protesting against the erection of the dam; and as we expect to get a great deal of power from Niagara Falls, anything that would affect them would affect us. Of course I am not prepared to speak as to the effect of the water upon the shipping interests, except that we only have now 12 or 13 feet of water at the Eastern Gap, and we prefer to have 15 or 16 feet if we could possibly have it. The greatest depth in the harbour I think is 30 feet, so that we could easily accommodate vessels drawing 15 or 16 feet of water. I heard you speak just now about the variations in the level of Lake Ontario. We have a record here, Mr. Chairman, that I prepared for you. (Chart produced.)

Mr. COSTE—Have you the dates?

Mr. RUST—I have only 1904 on. Mr. Postlethwaite, how high was the water last year?

Mr. POSTLETHWAITE—36½ inches.

Mr. COSTE—What is your zero?

Mr. RUST—Zero is an old mark fixed at the Queen's Wharf, 40.

Mr. COSTE—What is it referred to?

Mr. RUST—It is referred to a station that was placed in the Queen's Wharf Channel, isn't it, Mr. Postlethwaite?

Mr. POSTLETHWAITE—Yes. Of course it was necessary to start some datum from which to measure up and down.

Chairman MABEE—How much water is there at zero mark?

Mr. POSTLETHWAITE—It was nine feet above this rock, but the rock has been built over since then, and disappeared, but the zero mark has been retained, and we have the same zero mark now that we had in 1853.

Mr. CLINTON—What is the relation of the zero mark to tide water?

Mr. RUST—Here is the zero mark. (Pointing out the zero mark on chart). The water is more frequently above zero than below zero.

Mr. CLINTON—But what relation has your zero mark to mean tide?

Mr. COSTE—Are you connected in any way with the gauging at Kingston?

Mr. RUST—No.

Mr. COSTE—Entirely independent?

Mr. RUST—Entirely independent.

Mr. COSTE—I asked the question because I wanted to make a comparison between this work and the work done on the other side.

Col. ERNST—Is it not connected with the lake survey?

Mr. RUST—We have thrashed that matter out at the Canadian Society several times with a view to having established bench marks to the same gauge that the United States Army established. They have done a lot of work down on the southern shores of the lake, and we proposed to connect our bench marks with theirs so as to get the tide level.

Mr. COSTE—May I suggest, Mr. Sabin, that you ask Col. Adams, or the man in charge of the works on Lake Ontario, to give Mr. Rust, when the lake is perfectly calm, the reading on the other side? They have a gauge on some harbour; what's the name?

Mr. CLINTON—Olcott.

Mr. COSTE—Olcott; they have an automatic gauge there, where they keep their records, so as to have an idea to connect those levels with the others. They would be very useful to us.

Mr. RUST—Mr. Munro, I think, checked his levels along the Soulanges canal with the tide water at Quebec. There was some slight difference between the Ottawa Government levels and the United States levels. This was the high water mark last year—36½ inches above zero.

Mr. SABIN—Is your gauge checked up quite frequently with your bench marks?

Mr. RUST—Yes. This year it is not quite as high. I would say that the heavy easterly storms, combined with the high water, have washed away a great deal of the beach.

Chairman MABEE—It is more the storms that do that?

Mr. Rust—Yes, and that trouble has also been augmented by the construction of the Government pier at the eastern entrance to the harbour. The sand used to roll along the shore and be taken away from one place and put in another place; but the construction of the crib work out into the lake has held the sand on the other side, so that we don't get the amount of sand on the Island shore that we used to get.

Chairman Mabee—There likely is a good deal in that, I should think. Gentlemen, the Board of Trade is represented here by several prominent business men of this city. I would like Mr. J. F. Ellis to let the commission have his views.

J. F. Ellis, Esq., said—Mr. Chairman and Gentlemen—As a member of the Council of the Board of Trade we are here more to show you that we are interested in this important matter that is engaging your attention. We are not experts, and of course cannot advise you in a matter of this kind. It does appear to me, however, that as you have stated to us here to-day, the object of this commission is to prevent the water of Lake Erie from going below a certain zero mark, as you may term it, and the erection of a dam to do that. I believe it is a fact that whenever we have low water in Lake Ontario there is low water in Lake Erie; and when it goes away below zero in Lake Ontario, it does also in Lake Erie; and it seems to me that if you were to adopt any artificial means to prevent the waters of Lake Erie from going below a certain point, that it will only aggravate the evil in Lake Ontario—that is, that the waters of Lake Ontario would recede lower than they would if nature had its course. Now we know that the waters in Lake Ontario sometimes get so low as to be quite a hindrance to navigation. We have had a practical experience of it in the harbour of Toronto; and if the damming of Lake Erie would have that effect on the waters of Lake Ontario it would be a very serious matter for the province of Ontario, and also the adjoining country to the south of us. I do not know that I can say anything farther than that I am sure the commission will give the matter their very best attention, and get all the information they can on the subject.

Peleg Howland, Esq., First Vice-President, Toronto Board of Trade, said—Mr. Chairman, and Gentlemen of the International Commission. The Council of the Board of Trade have given this matter some consideration. They, however, were not furnished with very full information. We did not know the exact location of the dam, nor the distance that it was intended to increase the level of Lake Erie, nor the cost of the dam, nor how the cost was to be distributed, nor the benefits which were to be derived from the construction of this dam. Looking at it without all this information, the conclusion arrived at would be that the benefit would largely accrue to the Boards on the south side of Lake Erie; that to the similar Boards on the north side of Lake Erie it would be comparatively small. Of course it is realized that any benefit to general navigation that would lower the cost of transportation from our Northwest to the seaboard would benefit this country generally; but if the work is going to injure this province, or us locally, I think there is no question but what we would oppose it strenuously. Of course, as laymen we do not feel that we can express an opinion on an engineering project; but looking at it from a common sense point of view, as the Harbour Commissioner has stated, it does not seem possible to us to raise the level of the lake above us without, while that process of raising is going on, lowering, that is, reducing the flow of water into Lake Ontario and lowering the level of this lake. It would seem, too, that the first process of raising the level would not be the last one; that this would occur intermittently at periods of low water when it was necessary to keep the level of Lake Erie up. Now, if the lowering of the level of Lake Ontario would affect our harbour adversely

here, or the navigation below us, it would seriously injure us. For a very long time we have been advocating the deepening of the entrances of our harbour so that they would admit the vessels of full canal draught; and it is of the utmost importance, not only as a harbour of refuge, but to the traffic of this province, that this harbour should be maintained. No doubt when you examine the statistics of the traffic of this harbour they will appear extremely small to you; but the value of our lake and of our harbour to this city and to the province is chiefly as a regulator of railway freight rates, just as the St. Lawrence canal and as the Erie canal has been a regulator of freight rates, and it is only on that ground, I think, that the large expenditure on the St. Lawrence canal has been justified. I trust, therefore, gentlemen, that you will not recommend anything that will injure in any way our harbour, or the traffic of this lake, small as it may appear, because I think I am expressing the views not only of the Board of Trade but of the community at large when I say that we would oppose anything that would experiment with the levels of Lake Ontario.

Noel Marshall, Esq., said—Mr. Chairman, I don't know that I have anything special to say. I came here more to give my colleagues my moral support. So far as the harbour is concerned, I am a shipper to some extent. I have for many years warned the citizens that they don't know when they have a good thing. I believe that the Dominion Government and the city of Toronto officials are throwing away what is of the greatest possible value to the city of Toronto in the way they have used it themselves; and the only time when one knows what anything is worth is when somebody else comes along and is likely to do an injury to it. There is nothing in the world that would do so much to make men think what the value of Toronto harbour is. In the item of coal alone, the Toronto harbour, with the poor depth that it has, is worth half a million dollars to the city of Toronto. If we had 14 feet of water in Toronto harbour we would likely be using Canadian coal in Toronto instead of coal from Pittsburgh and Pennsylvania. So far as the question is concerned of raising Lake Erie at the expense of Ontario, I am glad to know that the governments jointly have appointed a commission to find out the facts. I am satisfied that the opinion you will get from the Canadian side is that we do not want Lake Erie raised at the expense of Lake Ontario; and while I am not an engineer, I do not see how you can empty the water from one pail and put it into another without one being short. If this meeting does not do any good it will make the people of Toronto realize that they have got what nature intended to be one of the best harbours in the world, and they are letting it go to waste.

R. C. Steele, Esq,. said:—Mr Chairman and Gentlemen. Like Mr. Marshall, I had not expected to be called upon, but came here as representing the Board of Trade, and to show interest in your matter. I would like at this point, on behalf of the Toronto Board of Trade, to assure the members of the commission that we appreciate very strongly the friendly spirit that brought about this commission, the friendly spirit that emanated from the Government of our neighbours to the south of us; and I would like to assure the commission, more especially those representing our neighbours, on behalf of the Toronto Board of Trade, that we are broad-minded enough not to desire to play dog in the matter at all; that we are broad-minded enough to be willing to enthusiastically support anything that will be for the benefit of the commerce of both nations. I wish the gentlemen to carry home that impression with them. But at the same time we are obliged, in our capacity as members of the Board of Trade, to scrutinize very closely anything that affects the commerce not only of the city of Toronto but the country as a whole. The Toronto Board of Trade represents very much wider interests than merely the city of Toronto. Anything that would affect Toronto harbour, or the other

harbours of Lake Ontario on either the north or the south shores, would be a great detriment to the commerce of the country; and I would say that we feel sure, looking at the personnel of the commission, and the pains that they have taken to gather information, that in any decision or judgment that you arrive at, we may rely upon your being on the side of safety. We look upon you as a jury investigating the commerce of this country; and if you have any doubt whatever in your recommendation, we wish you to give the prisoner the benefit of the doubt, and not disturb existing conditions if there is the remotest chance that injury would result. I might just repeat what I said to some members privately here in conversation. Some years ago at Rat Portage I saw an illustration on a limited scale of what might occur. I was looking at the dams that were constructed there. I am not able to give the area of Rainy lake—a very considerable area—and I was told that the waters of Rainy lake and Rainy river were raised for 180 miles back by those dams that had been constructed. The time that we were looking over the works the water below the dam was lowered some three or four feet. It was considered that perhaps ultimately that balance would be restored when the upper lake was filled to its capacity; but I was very much struck with the remark of Mr. Postlethwaite that if the outflow from the lower body was going out continuously, that that balance was not likely to be restored. Of course that may not be worth the time taken up to put it before you, but still it has presented itself to me, and I thought I would mention it; and I can only follow what has been said by my predecessors representing the city of Toronto and the Board of Trade, that we will feel compelled to protest, with all the energy that we possess, against any action that would possibly disturb the navigation interests of Ontario, not only on the north side of the lake but on the south side. I thank you, gentlemen.

F. G. Morley, Esq., Secretary of the Toronto Board of Trade, having been called upon by the Chairman, said:—Mr. Chairman and Gentlemen, I usually come with the deputations more as a layman, and not as a speaker. I therefore had no expression to make.

Chairman Mabee:—Is there any other gentlemen who desires to be heard with reference to any of the matters that will be of assistance to us? If there is not, in closing the meeting it may not be out of order for me to say that we understand this commission to be appointed in the business interests of the two countries, and in the spirit of friendliness which exists, and which should continue to exist, between these two neighbouring nations. (hear, hear). I think the Government of Canada viewed the invitation in a proper spirit. I think possibly I am as good a citizen of Canada as any one present, but I think that if we could by any joint action do anything that will assist the maritime interests along the lakes, without in any way making anything that would be detrimental to any other interests, it is only neighbourly and good business judgment to do it. (hear, hear). But in closing I think I can assure the gentlemen present, and the interests that they represent and stand for, that there is not even any desire on behalf of any of the members of the American section of this commission to disturb in any way natural conditions, that will have any injurious effect whatever upon the trade or commerce of the lake ports of the Dominion of Canada, and that anything that this commission will recommend will have entirely in view all of the down-stream interests; and I think it goes without saying that no recommendations will be made that will injuriously affect the lake ports below the Niagara river, either upon the north or the south side of Lake Ontario or the St. Lawrence river. (hear, hear). The commission is very much obliged, gentlemen for the information that you have given us, and the interest you have taken in our visit. I declare the meeting adjourned.

At twelve o'clock, the meeting closed.

At two o'clock in the afternoon the members of the commission took a trip around the harbour in the 'Island Queen.'

The party returned to Toronto about 5 o'clock.

During the visit of the harbour, it was ascertained from Mr. Colin W. Postlethwaite, Harbour Master, that dredging in various parts of the Toronto harbour was the only work engaged in by the Commissioners during the season of 1905. The expenditure on account of dredging for 1905 is as follows:—

In the Queen's Wharf Channel and approaches	$2,352.20
At Polson's Iron Works	1,170.75
At Church Street Coal Docks	1,734.60
Engineer's Fees and Check Clerk's salary	313.61
	$5,573.86

The Commissioners were informed by the Harbour Master that since the beginning of the present season of navigation, to the 14th September, the following quantities of goods arrived at the port of Toronto by vessels:—

General Merchandise, tons	25,814
Coal, Anthracite & Bituminous, tons	142,079
Lake Stone, toise	2,479
Ice, tons	4,344
Fruit, brls	1,327
Fruit, crates	10,101
Fruit, baskets	62,040
Fruit, bags	962
Horse, Carriages & Horned Cattle	149
Oil in bulk, barrels	9,942
Lumber, sawn, sq. ft	1,345,000
Sheep, in carcass	22

These figures compared with those of the two preceding years are most satisfactory. Here follows a comparative statement of goods arrived at the port of Toronto for the years 1903 and 1904:—

	1903.	1904.
General Merchandise, tons	29,800	31,603
Coal, hard and soft, tons	171,787	171,503
Wood, cords	67	.....
Lake Stone toise	3,095	3.258
Ice, tons	13,595	5,264
Fruit in packages, brls	769	5,065
Fruit in packages, crates	9,353	23,567
Fruit in packages, baskets	445,029	350,498
Fruit in packages, bags	224	986
Paving and Fire Bricks	129.000	130,000
Shingles, bundles	641,000	.....
Grain, bushels	.....	3,500
Horses and Carriages, etc	156	105
Coal Oil in Bulk, brls	18,626	10,141

The harbour was clear of ice on April the 5th, having been frozen for 115 days. The first vessel to arrive was the ss. 'Lakeside,' Captain Wygle, from St. Catharines, Ont., with passengers only, on March 27. The first vessel with cargo was the steam dredge 'Commodore Jarvis,' Captain Dorland, on the 4th of April.

In 1904 the harbour was clear of ice on April 22nd only, having been frozen for 130 days; this was the longest period on record, the winter of 1904 being exceptionally long and severe. Solid ice formed again on December 1904, three days earlier than in 1903. The first vessel to arrive in 1904 was the schooner 'Madeline' Captain George Atkinson, on April 22, with a load of stone.

Here follows a comparative statement of the arrival of vessels in 1904 and 1905, to December 26:—

	1904.	1905.
Propellers	395	319
Passenger steamers	2,063	2,136
Sailing vessels	389	367

The highest water level in 1904 in the Toronto harbour was 36½ inches above zero, on July 12; the highest water level in 1905 was 28 above zero, on the 28th of August.

Dredging was done in the Toronto harbour as well as in 1905. It was excavated from the bottom of the bay, in 1904, 15,908 cubic yards, at a cost of $4,239.90, as against 29,508 cubic yards, at a cost of $5,573.86, in 1905.

The total quantity of coal imported into Toronto in the year 1904, by rail and vessel, as per returns from the Government, is as follows:—

	tons.
Anthracite	565,136
Bituminous	695,323

in all 1,260,459 tons, which was 162,808 tons more than in 1903.

The figures for 1905 are not yet available.

Dominion Government Engineer Sing explained to the Commissioners that during the year 1904, the Sand bar, 500 feet south of eastern entrance piers, has increased, extending slightly to the west, so that it would become troublesome except at periods of exceedingly high water. There is 14 feet navigation over the whole of the bar, except late in the fall. The best depth of water in the channel is in the centre.

The harbour of Toronto being formed by a circular bay 1½ miles in diameter, and being separated from Lake Ontario by a low island (formerly a peninsula) about six miles long, is a safe and well-sheltered harbour, capable of containing a large number of vessels. When the improvements the Dominion Government is carrying on in the harbour of Toronto are completed it will be one of the best and finest harbours of the whole system of the Great Lakes.

On the 21st July, 1902, Messrs. Magann & Phin completed their contract, for the sum of $61,171, let to them on the 10th February, 1900, to extend the West pier, at the Eastern Gap, out into the lake, a distance of 800 feet.

The groynes at the southwest end of the island were constructed, and repairs made to the west pier of the eastern channel from Fisherman's island to the east pier, also repairs and renewals of the deck of the breakwater from the eastern channel westward.

During the winter of 1902-3, the heavy seas, caused by severe wind storms, have undermined the cribwork at the outer end of the east pier, and, for a length of 800 feet, this structure was liable to fall over into the channel. The cribs of the piers were only placed in 16 feet of water, and the channel has been dredged to 20 feet. Sheet pile protection work on the channel side of this pier was a necessity. The island shore, west from the end of the breakwater, has also suffered from the winter storms, and more groynes were required to protect this portion of the island.

During the season of 1903-4, four groynes were constructed on the south shore of the island, and repairs were made to the face timbers of east pier, also renewal of the deck of the east and west piers.

Dredging was carried on for a period of 33 days, but, owing to heavy fall storms, was discontinued.

The sum of $20,000 was appropriated for sheet piling 1,000 feet on channel side of eastern pier northwards from lighthouse, but as this work was only ordered to be proceeded with on the 30th October, it was impossible to procure materials to do anything during the fall. However, timber was brought in during the winter, and an early start made in the spring. Up to the 30th June, 927 lineal feet of the pilework had been completed.

During the season of 1904-5, 1,000 feet of the superstructure of the east pier northwards from the lighthouse, 30 feet in width and 5 feet in height was rebuilt.

Repairs were made to the stone talus protecting the breakwater for a distance of 700 feet.

Plans and specifications were prepared and tenders called for extension to breakwater, but at the end of the last fiscal year the work had not been let.

Some 1,400 feet of the northerly portion of the easterly pier of the eastern channel is now being reinforced with close sheet piling.

A contract has been let recently to Messrs. Haney & Miller for the construction of a concrete and interlocking steel pile breakwater which is to extend 1,500 westerly from the end of the present breakwater, on southerly side of the island, at the rear of this the city has agreed to fill in the space that has been eroded during heavy easterly storms.

Temporary protection works about 1,000 feet in length, consisting of a row of close pilework, with stone talus is being constructed to prevent any further damage to island shore while the permanent breakewater is being constructed.

APPENDIX 'Sg.'

PUBLIC Hearing held by the International Waterways Commission, in Hamilton, September 16, 1905.

CITY HALL, HAMILTON, Saturday, Sept. 16.

HIS WORSHIP MAYOR BIGGAR welcomed the Commission to Hamilton in the Council Chamber of the City Hall, where the following gentlemen met:—J. P. Mabee, Esq., K.C., Canadian Section; Thomas Côté, Esq., Secretary Canadian Section; Dr. W. F. King, and Louis Coste, Esq., members Canadian Section; Col. Ernst, George H. Clinton, Esq., and Louis Sabin, Esq., (Secretary) representing the American Section; His Worship Mayor Biggar; W. H. Steele, Esq.; Capt. Fairgrieve; Chas. Stiff, Esq., Secretary, Hamilton Board of Trade; W. A. Robinson, Esq., Manufacturer; Ernest G. Barrow, Esq., City Engineer; F. MacKelcan, Esq., K.C., City Solicitor.

J. P. MABEE, Esq., K.C., took the Chair at 10.30 A.M. and said—Mr. Mayor and Gentlemen. As most of you probably know, under an Act passed by the Congress of the United States in 1902, provision was made in the following terms: "That the President of the United States is hereby requested to invite the Government of Great Britain to join in the formation of an International Commission, to be composed of three members from the United States and three who shall represent the interests of the Dominion of Canada, whose duty it shall be to investigate and report upon the conditions and uses of the waters adjacent to the boundary line between the United States and Canada, including all of the waters of the lakes and rivers whose natural outlet is by the River St.

Lawrence to the Atlantic ocean; also upon the maintenance and regulation of suitable levels; and also upon the effect upon the shores of those waters and the structures thereon, and upon the interests of navigation by reason of the diversion of those waters or change in their natural flow; and further to report upon the necessary measures to regulate such diversion, and to make such recommendation for improvements and regulations as shall best subserve the interest of navigation in the said waters. The said Commissioners shall report upon the advisability of locating a dam at the outlet to Lake Erie with a view to determine whether such dam will benefit navigation; and if such structure is deemed advisable shall make recommendations to their respective Governments looking to an agreement or treaty which shall provide for the construction of the same, and they shall make an estimate of the probable cost thereof." The balance of the section refers to the constitution of the commission. Now, that invitation was communicated to the Government of Canada through the British authorities, and the result was that it was accepted, and this commission has been formed, three gentlemen representing the United States and three representing Canada. You will notice from the wording of the section that the duties of the commission end with making a report to their respective Governments. We have no authority to decide upon anything; and anything that we might agree upon in reporting would, as the section shows, have to be embodied in a treaty or an agreement between the two countries. We have visited a good many points along the international boundary line, both in the United States and Canada, with the object of collecting such information as the various interests that might be affected by any report that we might make, might have to offer. We have collected, so far, a large amount of information. We thought it only courteous to the different towns and cities of importance along these international waters that the interests —commercial, shipping, industrial and otherwise—at those various centres should have an opportunity of presenting their views to this commission. With that object in view we have come to the city of Hamilton. Hamilton is one of the old lake ports along the Canadian shore—a city that stands high in the commercial and business life of the Dominion of Canada. Just what information you may have to offer, of course we are not yet in a position to say; but if you have any, I assure you, on behalf of all the members of the commission, that when the time comes to make any report regarding these matters that have been referred to us, your representations will receive the most careful consideration by the whole of the members of the commission. I understand that there are gentlemen here representing different bodies and interests, who may have something to say. I also recognize—and indeed does the whole commission recognize in the same way—that you are largely at a loss to know what representations to make to us. We appreciate that, in so far as the suggestion mentioned in the section relating to the construction of a work on Lake Erie with the view of regulating the waters of that lake, that they are largely engineering questions. We fully appreciate that; but at the same time, as I said before, we thought it only common courtesy to give everybody an opportunity of being heard before anything at all was considered by the commission. I might just say, in order to clear the way: that as I understand it, the proposal or suggestion is not that the water level of Lake Erie shall be raised. Some misunderstanding exists in the minds of many people in the different communities as to what the proposal points to. It is not suggested that a work shall be located at the outlet of Lake Erie that will have the effect of raising the high water level in that lake. Indeed quite the contrary is the suggestion. The proposal is that this commission shall endeavour to ascertain if such a work can be established at the outlet of Lake Erie that will regulate the waters of the lake; that is, prevent abnormal low water, and also prevent abnormal high water. Of course every one knows, apart from any engineering knowledge, that if a dam were constructed across the mouth of the Niagara river, that it would raise the high water level of the lake,

and possibly do infinitely greater damage as the result of high water than is now felt by shippers as the result of low water. The proposition is to endeavour to so regulate the waters of the lake that the abnormal low water may be avoided. If any one representing the interests of the city of Hamilton can give us any light upon this matter, the commission will be most happy to hear them. The Mayor will introduce the different gentlemen who desire to speak upon these different subjects.

Mayor BIGGAR—I have very great pleasure in introducing to you Mr. R. T. Steele, the Chairman of the Transportation Committee of the Board of Trade of this City.

R. T. STEELE, Esq., said—Mr. Mabee and gentlemen, it is through no desire on my part to speak that I am placed in the position I now occupy, I can assure you; but your courteous invitation was extended to the Board of Trade, and it was handed over to the Transportation Committee, of which I am Chairman; and Capt. Fairgrieve, Mr. Robinson, the Secretary and myself were asked to come before you this morning. We had a meeting the other evening, and I can assure you we had quite a long discussion; and at the end of our discussion we seemed to be more at sea than when we started in, and we came to conclusion that in appearing before you to-day it would be more a matter of inquiries rather than answering, or giving you any data to work on. I thought right at the outset it would be better to convince you of our modesty in the matter. There is no doubt that this question has a prospect of being an important one, and it is on that account we would like to place ourselves on record in as intelligent a way as possible; and for that purpose we have formulated a number of questions to ask you, which I would be very glad to read out to you, or would hand you a type-written copy for your consideration, and if at your convenience you saw fit to answer them, we will give you in reply our written answer. Failing that, the only course that we can adopt is to suppose that the damming of this river is going to injure not only our Lake Ontario interests, but perhaps the interests of other lakes; and on that account it would be our duty to oppose that with all the force and with all the might in our possession. But we would not want to take an ignorant stand like that. As you have been good enough to ask an expression of opinion, we would like to give one as intelligent as possible; and the only way we could give it would be by getting some information I think at the outset of your remarks you practically told us that you did not expect us to know anything about this commission at all.

Chairman MABEE—Not at all.

Mr. STEELE—And we quite agree with you in that; and if what we have asked is in order, I should be glad to either read them out to you, or hand them to your Secretary, and then you can take what action you see best in the matter, feeling that we will take the action on the suggestion now not out of hostility or enmity but in ignorance. That is really all that I have got to say.

Chairman MABEE—Of course, Mr, Steele, regarding the questions, we came to seek information and not to give it; and inasmuch as your questions will direct our inquiries in the lines that you desire it, perhaps it might be as well that they should be filed with the secretary for our consideration.

Mr. STEELE—We should be glad to do that.

Chairman MABEE—And if there are questions involved that you feel you should have further discussion upon after we accumulate the information, we might arrange another meeting with you here, and go over the difficulties that seem to occur to your minds.

Mr. STEELE—They were all difficulties; you can quite imagine that.

Chairman MABEE— Mr. MacKelcan suggests that perhaps if you read the questions now it may open up some discussion, and that is what we came to hear.

Mr. STEELE—Some of these questions may of course appear to your experts rather out of place, but for a lot of common, every-day business men it was the best we could do, and we formulated them after quite a bit of discussion, and also some little information from some of our lake people. Capt. Fairgrieve is one of our oldest lake captains, and as far as the navigation of the lakes goes he is well posted; but he professed to be awfully ignorant as to the intentions of this proposed dam. I shall read them over to you:—

MEMORANDUM of the Transportation Committee of the Hamilton Board of Trade, re proposed dam at the outlet of Lake Erie.

Before arriving at a conclusion, the committee wish to obtain certain information which answers to the following questions will furnish.

1. Can the commission give the Board any information as to the effect that the construction of the Chicago Drainage canal has had on the level of the lower lakes?

2. Can the commission give information as to the effect on the current caused by the widening of the channel at the Lime Kiln crossing at Amherstburg?

3. What is the contemplated height to which it is proposed to raise Lake Erie?

4. Is the proposed height to be measured above the high, low or medium present level?

5. Has the commission any information as to the effect on the current into Lake Erie by the proposed dam at the outlet?

6. Has the commission any information respecting a change in the flow of water from the St. Mary's river caused by the Chicago Drainage canal?

7. Has the commission any information as to the change in the level of Lake Ontario, which would be caused during construction of the dam or subsequent thereto at any time of the year?

8. Will the backing up of the waters of Lake Erie have any effect on the waters of Lake St. Clair and consequently upon the low lying lands of Essex and Kent and the drainage works on which large sums have been spent?

9. Has it been considered that the passage of vessels through the dam openings or locks should be free (on both sides of the river) for the vessels of both countries?

10. Has the Commission any information as to the condition of farming lands on Lake Erie if the height of water on Lake Erie is permanently increased?

11. In what respect is the proposed dam to benefit the Transportation interests of Canada?

Mr. STEELE—Those are the various thoughts which came before us, and which we put in black and white, and if it will result in any information to you, or a guide so that we will be able to get your opinion, we shall be pleased.

MR. CLINTON—Mr. Chairman, I would suggest that the questions relating to the Chicago Drainage canal and matters of that sort might be entirely laid aside, especially for the present, for the commission will undoubtedly gladly furnish any information they have on that subject, but it will necessitate looking into the records and securing positive data. As to the other questions, I would like to say this on behalf of myself, and I know of the rest of the commission;

the effect of any proposed regulating works at the mouth of Lake Erie, either upon the waters above or the waters below, is an unknown quantity to the commission as well as to everybody else, as we are simply studying it, and have no definite project in view. The commission may even advise that no regulating works be built. The Act provides distinctly that the commission shall examine into the question of the advisability of having any regulating works; and when we have acquired all the information we can on the subject, and made a thorough study of it, we may come to the conclusion to advise that there be no regulating works. We may find that it cannot be done without injuring the navigation below, or at too great an expense by flooding above, or something of that sort. Those questions, it seems to me, cannot be answered to the satisfaction of these gentlemen so as to give them anything definite until we have some definite views of our own. The other questions can be answered by reference to such data as we have.

Mayor BIGGAR—Mr. Chairman, Capt. Fairgrieve, one of our oldest lake captains, will now address the commission.

Capt. FAIRGRIEVE—Mr. Chairman, as stated by the last speaker, when we are going into this subject we have a matter that is very, very uncertain. That was pretty much our position when we met and adopted those questions. I have been a good many years on the lake here, and the supply and flow of water one season with another, and seasons following, are most conflicting. The fact is altogether different from what would be naturally supposed to exist. Consequently in discussing our action the other night, we took up all these matters, and we concluded that we could not give any decided leaning towards the construction of the dam across Lake Erie. Personally, I might say, that if that dam at the foot of Lake Erie could be constructed without the damage that might occur that our questions dealt with, I think it would be a very good thing, but the uncertainty of the control of these waters and the depth of waters is so great, to our present knowledge, that we could not advise supporting it. At the same time we must admit that it is altogether an engineering question. We do not know what height they are going to put that. It is just as the chairman explained, and the last speaker also—that the depth is not going to raise. I did not expect anything of that kind. It was to prevent the very low water that that dam would be constructed; and if that could be done by retaining the water up to a certain height all the time, without affecting the levels of Lake Ontario and the St. Lawrence, it might be a good thing to support. We would have to get some advice or some report from engineers that would be in charge of this, which no doubt the commission will have to give us, before determining upon any such work. Being an engineering matter altogether, in talking it over we did not suppose that the wall would be finished and stopped up and then the water retained there until the water filled in. That no doubt will be provided for in the construction. That would lay us up for the season in Lake Ontario. But even with that, I don't know what the effect would be upon the St. Lawrence. We have the flow to the St. Lawrence, and if that is interfered with very much it affects navigation of Lake Ontario, because our navigation extends down there. That is another thing that we were doubtful of. So you see before we could decide to give our support we would require to know a little more about these things. As to the questions about the Chicago Drainage canal, that is a matter that is unknown altogether to me, and I expect to yourselves, what will be the effect of that. If the water is drawn off at the foot of Lake Michigan it would divert the current from the overflow to Lake Superior down that way, and we would get no use of it. That is what gave rise to that question. I suppose it was natural that we should have thought about that, because there seems to be a great deal of water, and the trouble we know that has existed between the flow

southward from the lake out through that channel has suggested that something may result from that that we don't know of at the present moment.

Mr. Clinton—There is a doubt existing in regard to that, but the facts require collection and study in order to give information.

Capt. Fairgrieve—It might be that that very flow might affect our flow down here. If the water at the lower end of the lake were lowered so as to create a current out that way, I think in time it would affect the flow from St. Mary, from Detour, down there and across Lake Michigan, instead of coming down Lake Huron. That is why that question was put there. I do not think there is any desire to be in opposition to anything that could be shown to be an advantage, because the advantage would be in some cases reciprocal; we would receive some advantages from Lake Erie as well as the Americans; and I have no doubt that otherwise, too, the American Commissioners will have to protect their people over there from very high water. So that I don't know that we have anything more to object to there than our friends across the line on the other side; and if we could get some of those questions answered we might have a meeting to consider them, and give what support we can, or stick to our decision that we would have to oppose it in the meantime. It is not through any unfriendly feeling to the cause or to the work, but it is our ignorance at the present time that makes us feel that we do not like to bind ourselves to support the suggestion. You will see we are not opposing it from any one thing, and that it is our ignorance of what the results might be.

Mayor Biggar introduced Mr. Chas. Stiff, Secretary of the Hamilton Board of Trade.

Chas. Stiff, Esq., Secretary of the Board of Trade, said—Mr. Mabee and Gentlemen, I really have nothing further to add to what Mr. Steele and Capt. Fairgrieve have said. In attending the meetings that we have had, of course I know of the discussion that has taken place. I don't know that my own views would add much to the information that they have already got; but one thing has struck me in connection with it, and that is, that the immense outlet on this dam would be undoubtedly a great deal of saving to our neighbours, but I cannot see to what extent it is going to benefit Canada. Some of these questions you have already answered, practically, in stating that the level in Lake Erie is not going to be interfered with. For instance, the 8th question has been practically answered, as to the effect it would have on the low lying lands of Essex and Kent; but really it does seem to me that the construction of such an enormous work would be of little practical use to Canada, or to this section of the country. Of course in the event of the height of water on Lake Ontario being interfered with at any time it ought to meet with our serious opposition.

Mayor Biggar:—I will now introduce Mr. W. A. Robinson, one of our largest manufacturers and shippers here.

W. A. Robinson, Esq., said:—Being a member of the board of trade, I have not much to say. I want to learn more than I can say myself. But this question, to my mind, is a most interesting one as well as a serious one. I know a great many poeple who live in Cleveland, and I remember some five years ago talking to a merchant in Cleveland, who, jocosely or otherwise, said, when we were speaking about the levels of Lake Ontario and Lake Erie, and the depth of those two lakes—'The time will come—not, perhaps, in many generations, I don't know how many, but it will come, when Lake Erie will be dried up, and just be a little river through the middle of it, and we shall cross over in a little canoe over to Canada.' You must remember that Lake Erie is only a pond. Lake Ontario is a very deep ocean; I think it goes below the Atlantic; but Lake

Erie, on the map of levels, is comparatively a mere pond of water. So that prediction bears on this subject somewhat—perhaps not in our time, but the time of future generations. That made me think of that lake, and I have often wondered, especially since we had the dam put across the Nile, whether a dam would be an advantage to both countries. In some ways you look at it, it looks as if it would be, and certainly if it injures either country of course it will injure both the same way, so that America as well Canada is equally interested. We hear of dams in all countries, where they wish to preserve the water that is running away to waste, and we know that the water from Lake Erie—or pond, as we might call it—does run away to waste to a large extent. We are trying now to utilize it by those turbine arrangements, but a lot of it still escapes no work being done by it. Now, in ordinary countries and under ordinary conditions, you dam up a lake in order to keep a steady, regular flow of water, so that it shall not be a freshet at one time and a dry river at another time. Now, if that were the object, and it would perform that result, it would be a good thing in every way; so that speaking generally, I should say that if it can be discovered by the engineering experts that it would not interfere with and injure the interests of all connected with the water below the dam, there could be no objection to it. I don't think it would injure anybody above the dam, because it would be one level—either the highest or the lowest or the medium would be arranged for. If this were accomplished, it would have to be stipulated that the Canadian Government would have to agree with any diversion of the water from Lake Erie. Suppose, for instance—I am speaking in ignorance, because I don't know the levels about Toledo and other places—suppose it should turn out that a canal could be made south from Erie and drain off a large quantity of water, for drainage or other purposes, that would certainly injure the interests of Lake Ontario, any water going that way to a large extent. I am much interested in this question as an individual, as a resident of Hamilton, and an old resident of this country. For that reason I think that if this movement will not injure the interests of Lake Ontario, nor below the dam, it seems to me it should be done providing those conditions can be reserved and guaranteed—that no water shall be drawn off Lake Erie, no more than at the present time, without the consent of both governments. I think that is all I can add.

Mayor Biggar:—On behalf of the City of Hamilton I would ask Mr. Barrow, who has a report to present to you, to address the commission.

Ernest G. Barrow, Esq., City Engineer and Manager of Water Works, Hamilton, read the following report which he had prepared for the Chairman and Members of the Finance Committee of the Hamilton City Council:—

Hamilton, Ont., Sept. 16, 1905.

Chairman and Members of the Finance Committee:

Gentlemen:—

In reply to a letter received from the Secretary of your Committee that I should report on what effect the proposed work on waterways adjacent to the boundary line would have upon the waters of Lake Ontario and our water works system, I would say that to make a report on a subject of so much importance and magnitude as the above would require more time than I, as a municipal engineer, could give.

I can say this much, however, positively, that should any lowering of the waters in Lake Ontario take place owing to a dam being placed in Lake Erie, that it would seriously injure our waterworks system, as the filtering head

and the water above the intake pipe would be diminished, which of course would impair our water supply.

For navigation purposes I consider any lowering of the waters of Lake Ontario would inflict serious injury.

Yours very truly,

(Signed) ERNEST G. BARROW,
City Engineer.

CHAIRMAN MABEE:—In reference to some of these questions embodied in this memorandum, propably Col. Ernst, the Chairman of the American Section, who has more or less indeed, I think, more knowledge—of matters connected with the Chicago Drainage canal than almost any one else—might make such remarks as occur to him as proper in this connection, and on any other matters covered by the questions.

COL. ERNST.—Mr Chairman, the Chicago Drainage canal has never been entirely completed. It was designed to take up eventually a volume of 10,000 cubic feet a second. Ten thousand cubic feet a second is less than 5 p.c. of the flow over Niagara Falls, which is about 220,000 cubic feet per second. So it does not bear a very important relation to the total volume of water coming down here. But even of that, the Chicago Drainage canal takes now less than half. It taps the Chicago river. Perhaps you know the Chicago river is the interior harbour at Chicago. It is a narrow, obstructed stream which is not capable of carrying a large volume of water; and the War Department, in its powers of conservieney, to protect the navigation in that river has limited the volume of water which can be taken through it into the Chicago Drainage canal, to 250,000 cubic feet a minute, which is about 4,166 cubic feet a second. The Drainage canal has not been fully at work, and the effect upon the lakes is inappreciable; it cannot be detected except by very prolonged measurements. I believe that answers the question as to what the Chicago Drainage canal has done. If the plans are carried out, it will eventually take out 10,000 cubic feet a second. As to the second question:—'Can the commission give information as to the effect on the current caused by the widening of the channel at the Lime Kiln crossing at Amhertsburg?' There can be only one answer, and a very vague one, that it reduces the current, of course. The volume of water to pass through a certain cross-section will pass at a lower velocity. The 3rd question is 'What is the contemplated height to which it is proposed to raise Lake Erie?" There is no contemplated height. This is simply an idea which is under discussion, and I think I can say for the commission that they are not going to try any experiments. If, after thorough investigation, the engineers find that there is a doubt, that they cannot be certain that they can regulate Lake Erie without injuring the waters below, the whole thing goes by the board. I think that is the view of this commission; certainly it is my view of it. Then these other questions are relating to a matter that is entirely in the air. We don't know. 'Is the proposed height to be measured above the high, low or medium present level? Has the commission any information as to the effect on the current into Lake Erie by the proposed dam at the outlet?' Well, almost none. It would be a very trifle. 'Has the commission any information respecting a change in the flow of water from the St. Mary river by the Chicago Drainage canal?' Well, the flow of water from the St. Mary river is into that lake Michigan-Huron—they are practically one lake —and it does not affect that, of course. It is away below. But whatever goes out through the Chicago Drainage canal will not go through the St. Clair river. It is rather less than the amount I mentioned as flowing over Niagara Falls.

'Has the commission any information as to the change in the level of Lake Ontario, which would be caused during construction of the dam or subsequent thereto at any time of the year?' We have a very large amount of information that has been collected in the field, but has not yet been studied up and digested, so that to answer the question eoneretely is not praeticable at this time. We don't know what the effect will be, but we have data from which we can aseertain we think. '8. Will the backing up of the waters of Lake Erie have any effect on the waters of Lake St. Clair and consequently upon the low lying lands of Essex and Kent and the drainage works on which large sums have been spent?' Of eourse if the waters of Lake Erie are backed up they would have an effect on the waters of Lake St. Clair. We don't intend to raise Lake Erie; but supposing we did, if we raised Lake Erie three feet it would wipe out all the slope in the Detroit river, and of eourse would raise St. Clair. '9. Has it been eonsidered that the passage of vessels through the dam openings or locks should be free (on both sides of the river) for the vessels of both countries?' That is a question of public policy which I think has already been solved by both nations. The canals are all free, and I suppose will continue to be free. '10. Has the commission any informatiou as to the condition of farming lands on Lake Erie if the height of water on Lake Erie is permanently increased?' Well, we don't propose to permanently increase it, and of eourse we have not the detailed information about the effect on special localities. '11. In what respeet is the proposed dam to benefit the transportation interests of Canada?' It would benefit the transportation interests of Canada just as it would those of the United States, but in proportion to their volume. The idea is simply, as the chairman has very clearly and concisely stated, not to raise the level of Lake Erie, but to maintain the mean level of Lake Erie; and to prevent abnormal low water and abnormal high water. But we don't know whether that ean be done or not, and we are going to find out.

Mr. Coste—I might supplement the remarks of Col. Ernst by saying that I have here the figures given by General Poe of the probable effect of the Drainage canal on the water of these lakes when the canal is in full operation, that is, taking 10,000 eubic feet per second whieh ,they are authorized to take. It would lower Lake Huron 0·521 feet. St. Clair, 0·455 ft. Lake Erie, 0·379 ft. And then the action ceases, and there is no appreeiable effect on Lake Ontario. The time that this movement will take is about five years. After they have taken the full supply of water it will take five years for that loss in height to take plaee; then the lakes will again be in equilibrium, and no further lowering will take plaee. I have looked over this report very carefully, and I think the conclusions reached by Gen. Poe are reasonable and perfectly clear.

Chairman Mabee—Mr. Clinton, do your desire to say anything further?

Mr. Clinton—Nothing further.

Chairman—Dr. King?

Dr. King—No, nothing.

Chairman Mabee—In declaring the meeting closed, on behalf of the eommission we desire to thank you, Mr. Mayor and gentlemen, for the ideas that you have given us. I assure you that we have listened with very great instruction to the speeches made by the different gentlemen who have appeared before the eommission this morning. You are mistaken if you think that you have not given us any information. I assure you that you have. As Col. Ernst very truly stated, this is an idea that we are endeavouring to study; and personally it afforded me the very greatest pleasure and satisfaction to hear the remarks made by Capt. Fairgrieve and Mr. Robinson. They re-echo exactly the senti-

ments that I have held in connection with this matter since my first connection with it; namely, that if, without imperilling the interests of navigation of the lake and river ports below Niagara river we can join in or assist the construction of a work on Lake Erie that will benefit navigation on both or either side of the lake, that it is a fair and a neighbourly and a business thing to do. That the United States ports on the lake might in the meantime obtain more benefit from the regulation of the levels upon Lake Erie is a matter that is of no moment whatever in my mind. That is only temporary. Our lake ports are growing up rapidly. The business of Canada is increasing with leaps and bounds, and in a very few years time I think we citizens of Canada will see along our lake ports just as important commercial and shipping interests as are now established along the American side of these frontier rivers and lakes. So that if this idea can be developed without imperilling the down-stream interests, I regard it as the interest of both countries, and the duty of both countries, to try and formulate some scheme in carrying it out. On the other hand, as Col. Ernst stated, if we at the conclusion of our inquiry ascertain that the level of Lake Ontario, or the harbours along Lake Ontario, or the River St. Lawrence will be injuriously affected, then the idea is not carried out, and there is an end to it, at least so far as that proposition is concerned. Again I thank you, Mr. Mayor and Mr. President and Secretary of the Board of Trade, for the interesting discussion that you have afforded us here this morning.

APPENDIX 'T.'

EXTRACT from a report of the Committee of the Honourable the Privy Council, approved by the Governor General, on November 29, 1905.

On a report dated November 17, 1905, from the Minister of Public Works, submitting that a meeting of the International Waterways Commission in the city of Buffalo, state of New York, on October 28, 1905, the following two resolutions, having reference to the use for manufacturing purposes of the waters of the River St. Mary and of River Niagara, were proposed and adopted:

'RESOLVED:—That this Commission recommends to the Governments of the United States and Canada that such steps as they may regard as necessary be taken to prevent any corporate right or franchises being granted or renewed by either Federal, State or Provincial authority, for the use of the waters of the Niagara river for power or other purposes until this commission is able to collect the information necessary to enable it to report fully upon the 'conditions and uses' of those waters to the respective governments of the United States and Canada.'

(Signed) J. P. MABEE,
Chairman, Canadian Section.

(Signed) O. H. ERNST,
Chairman, American Section.

'RESOLVED':—That in the opinion of this commission no further rights or franchises should be granted or conferred regarding the uses or diversions of the water flowing out of Lake Superior, by either the government of the United States or Canada, until all data and information are in hands of the

commission that may be necessary to enable it to make suggestions for regulating the excess of these waters, or that, if such privileges be granted, they be subject to any regulations that may be adopted by both governments.'

(Signed) J. P. MABEE,
Chariman, Canadian Section.

(Signed) O. H. ERNST,
Chairman, American Section.

The Minister recommends—with a view to ratifying the above recommendations—that the Government of Ontario be communicated with, laying before that government contents of said resolutions, with a request that such means be adopted as may be thought proper to ensure their being carried out.

The Committee submit the same for approval.

(Signed) JOHN J. McGEE,
Clerk of the Privy Council.

APPENDIX 'U.'

Whereas, by the River and Harbour Act, approved June 13, 1902, it is provided (32 Stats. L., 361) that, subject to the conditions therein mentioned: 'The Michigan Lake Superior Power Company, of Sault Ste. Marie, Michigan its successors and assigns, after first obtaining consent of the Secretary of War and the Chief of Engineers and their approval of the said canal and remedial works proposed, is hereby authorized to divert water from St. Marys river into its water-power canal, now being constructed at Sault Ste. Marie, Michigan, for water-power purposes, while and so long as such works and diversion of water from said river shall not injuriously affect navigation therein, nor impair or diminish the water levels or any natural increase thereof, either in Lake Superior, or in the United States ship canal and locks, or the navigable channels, locks, or ship canals connected therewith, whether natural or artificial, now existing or which may hereafter be established or created by the United States for navigation purposes.'

And whereas the said Michigan Lake Superior Power Company has submitted for the approval of the Secretary of War and the Chief of Engineers plans of its water-power canal and remedial works for the diversion of the water from the St. Marys river, authorized by said Act, and has applied for consent of the Secretary of War and Chief of Engineers to such diversions;

And whereas, the Chief of Engineers has approved the said plans and has given his consent to such diversion, subject to the acceptance by said company of the conditions hereinafter specified:

Now, Therefore, this is to certify that the Secretary of War hereby approves the said plans, which are hereto attached, and hereby gives his consent to the diversion of water from the St. Marys river, as authorized by said Act, subject to the acceptance by said company of the following conditions:

1. That the regulation works, including escape valves at power, controlling works, and remedial works, shall be operated under the inspection of the engineer officer in charge of the St. Mary's Falls canal, who shall have access to them at all times.

2. That when the mean level of Lake Superior at the canal for any calendar month falls below 601.5 feet above mean tide at New York, according to the levels of the United States Lake Survey Office, the flow through the canal shall be reduced, the amount of reduction increasing as the monthly mean level falls until it reaches 601:0, when all flow shall be stopped until the monthly mean level again exceeds 601:0, all without claim against the United States or against any officer thereof.

3. That in addition to the requirements of conditions 2 (supra), all flow shall likewise be stopped, without claim against the United States, or against any officer thereof, should the monthly mean level of the lake remain below 601.5 for a period of six consecutive calendar months, and shall not be resumed until the monthly mean level shall exceed 601.5.

4. That when the monthly mean level rises above 603.0, the flow through the canal and the remedial works shall be increased to their maximum capacity, and shall so continue until the monthly mean level shall be less than 603.0, without claim against the United States or against any officer thereof.

5. That should the monthly mean level of the lake remain above 603:0 for a period of six consecutive calendar months, said company shall alter its work at its own expense as soon as practicable, so as to allow more flow.

6. That the United States shall have the right to assume entire control of the flow of water through the canal and remedial works in cases of accidents, or of emergencies temporarily affecting navigation through the United States ship canal.

7. That should cross currents detrimental to navigation be created by the intake or by the outflow of the canal, said company shall construct such booms, training walls, or other works as may be necessary to remedy the evil.

8. That said company, in its arrangement and construction of remedial works shall leave a suitable channel and water flow for the passage of logs over and through St. Marys falls.

9. That these limitations are in addition to the special limitations of the Act of June 13, 1902, regarding riparian or other rights of any person or corporation and the remedies therefor.

10. That the elevations above mean tide at New York, above specified, are those established and in use at this date by the office of the survey of the northern and northwestern lakes, commonly known as the Lake Survey Office, at Detroit, Michigan.

11. Finally, the object and aim of the foregoing paragraph being to hold the waters of the lake and river under the absolute control of the United States in the interest of navigation, it is expressly understood that said company shall not be entitled to damages should the government at any time or for any cause exercise its right to control and suspend the flow of water through the power canal, in the interest of navigation.

Witness my hand this 12th day December, 1902.

(Signed) ELIHU ROOT,
Secretary of War.

This instrument is also executed by the Michigan Lake Superior Power Company, by Francis H. Clergue, its president, thereunto lawfully authorized, this 9th day December, 1902, in testimony of the acceptance by said company of the foregoing conditions.

THE MICHIGAN LAKE SUPERIOR POWER CO.
(Signed) By Francis H. Clergue, President.

Attest:

H. Von Schon,
F. T. Trempe.

(Seal)

APPENDIX 'U1.'

PUBLIC Hearing held at Buffalo, N. Y., November 10, 1905, as regard the uses and conditions of the waters of St. Marys River.

Present—

American section: Commissioners Ernst, Clinton and Wisner. Secretary Sabin.

Canadian section: Commissioners Mabee, Coste and King. Secretary Côté.

Appearances: William Livingstone, for Lake Carriers' Association; H. G. Goulder, for Vessels interests; H. A. Kelley, for Cleveland vessel owners; Robert Gray, for Michigan vessel owners; Harvey L. Brown, for Buffalo vessel owners; John H. Goff, for Chandler-Dunbar Co.; John C. Shaw, for Michigan-Lake Superior Power Co.: Alex. Dow and G. S. Williams, for Edison Sault Electric Co.; N. W. Rowell, for Lake Superior Power Co.

CHAIRMAN ERNST: The commission will please come to order. The special object of the meeting to-day is to discuss the matters at the Soo. All the interests there have been invited to come here byr epresentatives and give the commission the benefit of their views on the various questions involved at that place. We have drawn up a series of rules and regulations, more to give a starting point for the discussion than anything else. These are not authoritative in any sense, they have not been adopted by anybody. They are presented to this meeting for discussion, and they read as follows:—

RULES:

1. Neither the government of the United States not the government of Canada shall grant permits for the use of the water of St. Marys river in excess of one-half the natural flow less the amount needed for navigation purposes.

2. The amount needed for navigation purposes shall for the present be assumed at 4,000 cubic feet per second, but neither government shall permanently alienate its right to increase that amount indefinitely.

3. The level of Lake Superior shall be maintained as nearly as possible between the elevation 601·5 and 603·0 feet above mean tide at New York, as established and understood at this date by the United States Lake Survey Office at Detroit, Michigan.

4. Hereafter no corporation or person shall be permitted to divert water from the St. Marys river, or excavate any channel or erect any structure therein, without the joint approval of the Secretary of War of the United States, and the Minister of Public Works of Canada; and such approval shall not be given until said corporation or person shall have submitted full plans of all their works to the International Commission, and until said commission shall have reported thereon. *Provided*, That until such plans can be submitted and reported on, the Michigan Lake Superior Power Company, now operating power works at Sault Ste. Marie, Michigan, may use 8,500 cubic feet per second, and no more, and the Chandler-Dunbar Company, at the same place, may use 4,000 cubic feet per second, and no more, and the Lake Superior Power Company, at Sault Ste. Marie, Ontario, may use 7,000 cubic feet per second, and no more, all under the same rules and conditions as those under which they have heretofore exercised these privileges; and *Provided further*, That this rule shall not apply to contracts now in force for the excavation of channels by either government for the benefit of navigation.

5. Plans for the diversion of water must include such remedial and controlling works in the bed of the stream as may be necessary to maintain level, and must provide a suitable passage for logs over the rapids.

6. Before a permit to use or divert water be granted, the corporation or person seeking said permit shall, by a proper instrument, bind itself or himself to abide by the regulations hereafter prescribed and by any reasonable modifi-

cation thereof which may from time to time be recommended by the International Commission and approved by the Secretary of War of the United States and the Minister of Public Works of Canada.

7. Permits to divert water for power purposes shall be for a period not exceeding five years, and at the end of that period shall lapse unless renewed.

8. Nothing herein contained shall be held to affect any existing riparian or other rights of any person or corporation, or the existing remedies therefor, or any action at law or equity now pending. All remedies herein provided shall be cumulative, and shall be without prejudice to any other remedies, either of the United States or Canada, or of individuals, for failure of the power companies to maintain the levels for navigation purposes.

9. Corporations or persons using the water of St. Marys river for power purposes shall operate them under the following

REGULATIONS :

(a.) The regulation works, including escape valves at power house, controlling works, and remedial works, shall be operated under the joint inspection of the Engineer Officer in charge of the St. Marys Falls canal on the American side, and the Superintendent of the St. Marys Falls canal on the Canadian side, either or both of whom shall, in person or by deputy, have access to them at all times. These officials are required to see that these regulations, and any modification thereof which may hereafter be made by proper authority, are duly obeyed.

(b.) When the mean level of Lake Superior for any calendar month falls below 601·5 above mean tide at New York, the flow through the canals and power houses shall be reduced, the amount of reduction increasing as the monthly mean level falls, until it reaches 601·0, when all flow shall be stopped until the monthly mean level again exceeds 601·0 all without claim against either of the two governments or against any officer thereof.

(c.) In addition to the requirement of the preceding paragraph, all flow shall likewise be stopped, without claim against either government, or against any officer thereof, should the monthly mean level of the lake remain below 601.5 for a period of six consecutive calendar months, and shall not be resumed until the monthly mean level shall exceed 601·5

(d.) When the monthly mean level rises above 603·0 the flow through the canals and remedial works shall be increased to their maximum capacity, and shall so continue until the monthly mean level shall be less than 603 without claim against either government, or against any officer thereof.

(e.) Should the monthly mean level of the lake remain above 603·0 for a period of six consecutive calendar months, the corporations or persons using the water for power purposes shall alter their works at their own expense as soon as practicable, so as to allow more flow, in the manner to be prescribed by the International Commission.

(f.) In case of accidents or emergencies temporarily affecting navigation through either the United States or Canadian ship canals, the inspecting officers mentioned in Regulation 'a' shall have the right to assume entire control of the flow of water through the canals and remedial works, without claim against either government, or against any officer thereof.

(g.) Should currents detrimental to navigation be developed by the intake or by the outflow of any power canal, the corporation or person operating such canal shall construct such booms, training-walls, or other works, as may be necessary to remedy the evil, in the manner to be prescribed by the International Commission.

(h.) If the remedial works be used for the passage of logs, under Rule 5, the gates must be operated at the expense of the power companies whenever needed.

The Lake Carriers' Association we will hear first, if you please. I understand that the only representative here now is Mr. Robert Gray.

Mr. Robert Gray: Well, Mr. Chairman and Gentlemen of the Commission, I did not come down to represent the Lake Carriers because I was hardly in a position where I could assume that for myself. I am interested in the Lake Carriers. I represent a number of vessels the owners of which are members of the Lake Carriers' Association. I came down more in my private capacity, to see what the request was that was made of this commission and what these people were asking for up at the Soo, and I only understand in a general way the situation there, and perhaps until I have heard from some of the others I am not in position to give anything in detail. I view, as a vessel man and interested in vessel interests, the situation to be as follows: That the government, in order to protect the vessel interests in the waterways of the Great Lakes, should look to it that nothing is given away that will be needed at any future time for the purpose of aiding and facilitating the maritime interests of the Great Lakes. Now, as I understand the situation at the Soo the request of the Chandler-Dunbar people for certain privileges there might not interfere at the present day with anything that the government might do for the maritime interests, but certainly if the interests continue to grow and increase and the demands for greater facilities are made in any comparison with what has been in the past, there is no telling to what limit the government will want to assist by giving greater facilities in turn in the nature of locks, and if anything is done in the vicinity of the Soo locks which will encroach upon the waterways you are only putting obstacles for the government to get greater facilities in locks. Now, it seems to me that anything in the nature of ownership of the government should be preserved for the future requirements. Now, as I stated, I don't know just what the request is that has been made of this commission, and until I know that, I could hardly say anything more than in a general way that I view with jealousy any encroachment upon the government ownership at that point.

Chairman Ernst: Mr. Livingstone, we are calling on the Lake Carriers' Association first and the only gentleman present was Mr. Gray who has just spoken. If you would like to speak now on behalf of the Lake Carriers' Association we shall be glad to hear you.

Mr. Livingstone: Mr. President, I was a little in doubt as to just what was the purpose of this meeting. Of course I had a general understanding that the question of water levels was to be discussed.

Chairman Ernst: At the Soo, water levels at the Soo.

Mr. Livingstone: I rather have a feeling that I would like to hear what is presented, before talking on the subject. Of course our own position is quite pronounced in the matter, and if it will facilitate matters I am entirely ready to state our position on the matter, reserving the right to reply to some things that may be said later on.

Chairman Ernst: Then you prefer not to speak now?

Mr. Livingstone: I have no objection to speaking now as far as stating in a general way our position. I would do that with pleasure. But I would not like to feel, if I speak now, that that would shut me off from replying to something that might be said later on.

Chairman Ernst: That will probably not occur anyhow, but if you prefer to wait we will call on somebody else.

Mr. Livingstone: I would prefer to wait a little while, yes, sir.

Chairman Ernst: All right. The Chandler-Dunbar Company has several representatives here. Mr. Dow, the attorney, has been furnished with a copy

of those regulations to which I referred a moment ago. The commission would be glad to hear from him or any other representative of that company which they may prefer to speak first.

Mr. Alex. Dow: Mr. Chairman, Mr. Dow appears for the Edison-Soo Electric Company, the lessee of the Chandler-Dunbar Company, and Mr. John Goff, the attorney of the Chandler-Dunbar Company, appears for that company. I have also asked Mr. Gardner S. Williams, who is the engineer employed by us on the design of our new works at the Soo, to be present, so that if any discussion of engineering questions should arise we might place his knowledge of these matters at the service of this commission. As I understand the case, the status of the Chandler-Dunbar Company and of its lessee are identical here and that therefore, unless I expressly state to the contrary, anything that I say may be taken as for both concerns. The differences between those two properties are differences of ownership and such as arise from the relation of lessor and lessee, and our policies do not at all times coincide, but inasmuch as there seems no reason why, before this commission, there should be any difference of interest, I will, with your consent, speak on those lines.

We received from Mr. Sabin, the secretary of the American Section of this commission, a letter stating that the foundation of certain proposed new regulations would be the rules approved by the Secretary of War, December 12, 1902, concerning the diversion of water by the Michigan-Lake Superior Power Company. A copy of those rules was furnished us. You will notice that these rules differ somewhat from the draft of proposed new rules which have been furnished us this morning. Without giving more than a few minutes of consideration so far possible to the new rules we are not prepared to fully say how they will affect us. The actual regulation of the use of water as embodied in those proposed new rules is discussed in a brief prepared by us and of which I will turn over to the commission half a dozen copies so that it may be in the hands of the members of the commission. With your leave I will put these on the table for the members of the commission.

Mr. John C. Shaw: Mr. Dow, will you furnish us with an extra copy?

Mr. Dow: I think I can, Mr. Shaw. I am short of copies. We had this typewritten late last night.

Mr. Dow submits signed brief by Mr. Goff as follows:—'Memo concerning new regulations proposed to be framed by the International Waterways Commission, relative to the use of water of St. Marys river for power.

Preliminary.

A letter of Mr. L. C. Sabin, Secretary, American Section of the International Waterways Commission intimates that the foundation of certain proposed new regulations will be the rules approved by the Secretary of War, December 12, 1902, concerning the diversion and use of water by the Michigan Lake Superior Power Company.

The Chandler-Dunbar Water-Power Company and its lessee, the Edison Sault Electric Company, cannot admit directly or indirectly that the Michigan Lake Superior Power Company has sufficient authority for the diversion of water from the St. Marys river. This discussion, in response to the invitation of the International Waterways Commission, of the existing regulations as a basis for proposed regulations is therefore submitted without prejudice to the legal rights of the Chandler-Dunbar Company and its lessee, which are expressly protected by the Act of Congress of June 13, 1902.

Discussion.

1. Because the power development of the Michigan Lake Superior Power Company differs radically in its method and in its possible effect upon the lake

levels from the power development of the Chandler-Dunbar Company, no equitable rule intended to secure the maintenance of lake levels can apply at all times equally to the two properties.

2. The essential difference in possible effects is that the Michigan Lake Superior Power Company's works may increase the discharge of Lake Superior but cannot reduce the same; while the Chandler-Dunbar works may reduce the discharge but cannot increase the same.

3. Therefore, any rule designed in the interests of navigation to preserve lake levels against injurious effects of these power developments should, when the injury to be avoided is due to increased discharge of Lake Superior, take effect in the first place upon the works of the Michigan-Lake Superior Company and should not apply to the works of the Chandler-Dunbar Company until the discharge through the works of the Michigan-Lake Superior Power Company has been completely stopped. Conversely, any rules designed to prevent injury due to decreased discharge of Lake Superior should take effect in the first place on the works of the Chandler-Dunbar Company and should not apply to the works of the Michigan-Lake Superior Power Company until discharge through the works of the Chandler-Dunbar Company has been raised to a maximum.

4. A rule which would require a simultaneous decrease or increase of discharge through the works of the two Power companies would be unjust in that it would impose upon each company the duty of providing a remedy for a condition caused or aggravated by the works of the other company, and in no way due to its own works.

5. With reference to the special case of low water in Lake Superior, requiring a decreased discharge through the St. Marys river. We respectfully submit that inasmuch as the works of the Chandler-Dunbar Company cannot cause or aggravate the condition of low water, a rule providing for that condition should further, be so formulated as not to require the closing of the gates of the Chandler-Dunbar Company until and unless (a) the free flow of the rapids shall be cut off; and (b) until and unless a pro rata reduction of flow shall be required and caused in any other works of similar characteristics using the flow of the rapids.

6. To require the Chandler-Dunbar Company to close its gates for the purpose of remedying a low stage of water in Lake Superior while water continued to flow freely over the rapids would be to impose upon a private corporation the duty of maintaining at its own cost the level of Lake Superior, for the purposes of international navigation.

7. To require the Chandler-Dunbar Company to close its gates for the purpose of remedying a low stage of water in Lake Superior without imposing a similar requirement upon other works then capable of use as remedial works against low water in Lake Superior, would be unjust discrimination. It is expressly pointed out that the works of the Michigan-Lake Superior Power Company cannot be used as remedial works against low water, but only as remedial works against high water.

All of which is respectfully submitted.

THE CHANDLER-DUNBAR WATER POWER COMPANY

By JOHN H. GOFF,

Its attorney.

Dated November 10, 1905.

Mr. SHAW: I wish return this to you.

Mr. DOW: Well, as you will. There will be plenty of copies later. I will speak as from this brief and leave it in your hands as a condensed statement of our case.

In the beginning of course we wish, in discussing these regulations for the Michigan-Lake Superior Power Company, to carefully avoid any reference to disputes between us and the Lake Superior Power Company but nevertheless to have it understood that this discussion is without prejudice to the legal rights of the Chandler-Dunbar Company which are expressly protected by the Act of Congress of June 13, 1902, referred to in those regulations. That is to say gentlemen, we have no wish to bring those disputes before this commission, and while facts which are essential in these disputes will have to be touched upon, yet we appreciate that our quarrels are not necessarily a matter of interest or of service to the Waterways Commission.

Now in the discussion of these rules we state that, firstly, because the power development of the Michigan-Lake Superior Power Company differs radically in its method and in its possible effect upon lake levels, from our power development, no equitable rule intended to secure the maintenance of the lake levels can apply at all times, that is to say, simultaneously, to the two properties. We point out further that the essential difference in possible effects upon lake levels is that the Michigan-Lake Superior Power Company's works may increase the discharge of Lake Superior but cannot reduce the same. Let me enlarge on this brief at this point in saying that where I speak of the Michigan-Lake Superior Power Company's works I speak expressly of the canal with its appurtenances on the Michigan side and not of the so-called remedial works on the Canadian side, the title to which is, we believe, in a Canadian corporation and not in the Michigan corporation on the American side. The essential difference then in the possible effects on navigation of the Lake Superior Power Company's works and ours is that their works may increase the discharge of Lake Superior but cannot reduce it, whereas our works may reduce the discharge but cannot increase the same. If you wish that matter gone into more fully I would like to refer it to Mr. Williams. But, briefly, the Michigan-Lake Superior Power Company has opened a canal around the rapids which virtually increases the cross-section of the St. Marys river by an area equal to the discharge area of the canal. On the other hand, the works of the Chandler-Dunbar Company are of the character of intercepting wing dams diverting the flow coming over the crest of the rapids, or a certain part thereof, into the works of the company and those works, particularly the new works—and I may say that the old works we expect to see abandoned within twelve to fifteen months—are so designed as to use, under all ordinary conditions, the natural flow which would come through the intercepted cross-section, or if that be not used effectively for making power, at least to spill that natural flow. In the design of these works we have carefully kept in mind the necessity that we should be able to preserve the natural flow of the rapids, to pass the water on in exact quantities, and at such seasons as it would pass on were we not there at all. Now it will be obvious to you that if we closed our gates we would stop that flow and that would tend to raise levels on Lake Superior but that nothing we can do can tend to reduce levels on lake Superior. Therefore, our works, in their possible effect on Lake Superior levels—and of course I need not tell an engineering party that the level of Lake Superior is the controlling factor in the discharge of the St. Marys river,—therefore, the level of Lake Superior may be reduced by the effects following the operation of the work of the Michigan-Lake Superior Company, namely, the power canal, whereas it can only be raised and cannot be reduced by ours.

Therefore, I wish to point out to you that a rule simultaneously placing upon the two properties the duty of maintaining levels either upwards or downwards would not be equitable. Any rule designed in the interest of navigation, to preserve lake levels from the injurious effects of these power developments should, equitably, when the injury to be avoided is due to decreased discharge of Lake Superior, take effect in the first place upon the works of the Michigan-

Lake Superior Power Company and should not apply to the works of the Chandler-Dunbar Company until the discharge through the works of the Lake Superior Power Company has been completely stopped. Conversely, any rule designed to prevent injury due to the increased discharge of Lake Superior should take effect in the first place on the works of the Chandler-Dunbar Company and should not apply to the works of the Michigan-Lake Superior Power Company until discharge through the works of the Chandler-Dunbar Company has been raised to a maximum.

Now, briefly, gentlemen, this argument is that in your proposed rules you should differentiate between the two cases of the falling levels which you desire to remedy or rising levels of Lake Superior which you desire to remedy and that the regulation should apply in either case to the works of the company, and entirely to the works of that company, whose operations may tend to either produce or aggravate the trouble which you are trying to remedy, and until the extreme amount of remedial work or regulation or stoppage or increase of flow possible has been effected upon the works of that company, no action should be taken to alter the operations of the other company who is not responsible and cannot be responsible for either the existence of the condition you wish to remedy or for the aggravation of that condition. We ask you to differentiate, therefore, between the case of rising levels and of falling levels, in this sense; That in the one case the rules should apply, firstly, to the works which cause rising levels or tend to aggravate rising levels, and only sequent to that action to the others; and conversely with decreasing levels. We point out that a rule which would require the simultaneous increase or decrease of discharge through the works of the two power companies would be unjust in that it would impose upon each company the duty of providing a remedy for a condition caused or aggravated by the works of the other company and in no way due to its own works.

Now I ask you to notice, gentlemen, we do not, by any means, ask you to leave us out of regulation. We say we could not possibly, by anything we can do, let down the level of Lake Superior. We have taken the greatest pains to maintain that condition. We have also, although that is incidental, taken pains to provide that we may maintain the discharge of Lake Superior even if we are not effectively using the water.

We, therefore, submit that we should not be, in the first place, asked to remedy increased discharge of Lake Superior, by the operation of our works. On the other hand, we say our co-users of water, the Michigan-Lake Superior Power Company, may, by their action, increase the discharge of Lake Superior and hereby tend to produce or aggravate a condition of low water, which we could not do, and that therefore they should not be, in the one case, asked to remedy high water before we have done all we can, nor should we be asked to remedy low water until they have done all they can.

Now, with reference to the special case of low water in Lake Superior, this particular case of low water requiring a decreased discharge through St. Marys river, we respectfully submit that inasmuch as the works of the Chandler-Dunbar Company may not cause or aggravate the condition of low-water, a rule providing for that condition should further be so formulated as not to require the closing of the gates of the Chandler-Dunbar Company until, in the first place, the free flow of the rapids shall be cut off, and until, in the second place, a pro rata reduction of flow shall be required and caused in their works of similar characteristics using the flow of the rapids.

Now, following my brief, to require the Chandler-Dunbar Company to close its gates for the purpose of remedying a low stage of water in Lake Superior while water continues to flow freely over the rapids, would be to impose upon a private corporation the duty of maintaining, at its own cost, the level of Lake Superior for the purpose of international navigation. In other words, it would

mean this: low water, we will say, exists or is threatened in Lake Superior. The Chandler-Dunbar Company at the present time only uses or can use a small part of the flow of the American side of the rapids. There are works which we understand have general engineering characteristics of the same kind, in that they intercept flowing water and are not works constructed in diversion canals on the other side of the river.

We submit that a rule which, in order to maintain levels on Lake Superior, would ask us to operate our works in the first instance as remedial works, not merely incidentally as such, should apply to all similar works now or hereafter to be put up.

We also say that inasmuch as we cannot possibly have produced this case of low water nor have aggravated it, that so long as water is flowing freely over the rapids, the stoppage of which water would tend to maintain the level of Lake Superior, we, who are using water in free flow and in no wise increasing that flow, should not be asked to divert our works from their initial purpose of power development to make them serve as remedial works; that to impose that upon us would be to impose upon us, private parties, a public duty, a duty in the interest of navigation.

Now, that incidentally our works may be of service to navigation and that incidentally we would desire and are willing to be of service to navigation is obvious and correct, but that our works should be asked primarily to serve as a retaining dam for Lake Superior, to remedy a condition of low water which we have neither caused nor aggravated, is, we submit, the diversion of private property to a public use for which no compensation is provided. Such incidental use of our works in that way as may be possible is quite large and that we would, to that end, place our works under the control of proper authorities to be used to that end, of course goes without saying. But we call your attention to that.

That is to say, briefly, in the special case of low water, to ask us to remedy that low water, while water flowed freely over the crest of the rapids, would be to ask us, private parties, to perform a public duty. If we do that for value received, that is one case; if we do it merely because we are ordered to do it, it is not exactly a proceeding that we think this commission would approve, or, indeed, such a proceeding as this commission contemplates.

We want to point out, simply repeating this thing again—it should not be necessary to a commission—in summing it up, that the condition of low water to which we refer is one which cannot be remedied by any use of the works of the Michigan-Lake Superior Company, that is, the canal on the Michigan side, because the shutting of those gates merely reduces the cross-section of discharge to its original value. A low water section, due to natural causes, would be aggravated by the opening of those gates but cannot be remedied by the closing of those gates. On the other hand, nothing produced by natural causes which could not be remedied by the opening of our gates can be remedied by the closing of our gates and for the time-being of our going out of business. That is the particular reason for the discussion of this condition of low water.

The brief I have placed in your hands, gentlemen, contains concisely what I have said at some length.

In regard to the new regulation there is something to be said briefly, but if the commission permits a presenting to the commission, the fact that this draft of new rules has been in our hands merely since we came in this room, we would like to be allowed to consider them a little further before speaking. The intent of the rules is, on the face of it, excellent and one with which we can find no fault. We recognized at all times the paramount importance of navigation and we have never during our corporate existence overlooked that fact, and we have in many ways, which it is not necessary to enlarge upon, considered that. Within the last twelve months—to show the way in which we have

considered it—the very fact which has been mentioned by Mr. Gray, namely, that our works might be upon land at some time required for the erection of a canal or the construction of an additional lock, has caused us to earnestly ask permission to erect the new works we are now erecting at the farthest point out in the rapids that was possible and I regret to say that circumstances affecting the unfortunate litigation prevented our application being dealt with in the spirit in which it was made and also in the spirit in which we believe it was received by the Engineering Department. We have appreciated at all times that the farther out we went with our developments the more room we left between us and the canals, the less likelihood there would be of our works being required for public purposes and, therefore, the less likelihood there would be of our being disturbed, and on the other hand, the less would be the contingent expense of developments, and I regret to say exceedingly that our applications this year intended to take us out to the farthest limit, were reluctantly refused by the War Department because of matters connected with litigation, purely technical matters, I may say, and matters having no essential bearing on the case. That was admitted by all parties, even by the legal authorities having the case in charge.

Therefore, I may say that generally, in commenting upon your draft of new rules just received by us, that the intent is excellent, that you can depend upon our thorough co-operation and that such exceptions as we are likely to take to these rules will be exceptions, generally speaking, to the wording and not to the intent. If I may be permitted to look over with the counsel of the Chandler-Dunbar Company and to speak briefly as to matters of wording afterwards, I would like to do so.

Chairman Ernst: We will be very glad if you will, Mr. Dow, and point out definitely and distinctly which rules you object to.

Mr. Dow: Yes. Well, the so-called regulations are covered by the brief I have placed in your hands. The question as to these regulations is that we ask you to consider the different character of the works and to differentiate in the time of operation on the two sets of the works because of their different character. Otherwise I think there is little exception to be taken.

Chairman Ernst: What I meant was that we would like to have you point out distinctly which regulation. There are two sets of rules or regulations, whatever you wish to call them, here. The rules are for the guidance of the Government; the regulations are for the guidance of corporations which have received permission from the Government.

Mr. Dow: Precisely. Then, Mr. Chairman, the brief placed in your hands is, to all intents and purposes, a discussion of those rules and the principal objection is that the rules are, on their face, simultaneously operative upon all power developments, whereas the different character of the power developments requires, in equity, that rules to provide for the danger of low water should operate in the first instance on certain power developments and rules to provide for high water should operate in the first instance on other power developments.

Com'r. Clinton: Mr. Dow, your idea is that that should be specifically stated in any regulations which are adopted?

Mr. Dow: I think so, remembering that if you do not do so the assumption will be that reduction of flow would be pro rata; common practice in such cases would call for a pro rata reduction, and the question of prior rights, which will inevitably get in the courts, can, I think, be avoided by such a regulation as I have suggested.

Com'r. Clinton: Must not something be left to the discretion of the officials having in charge the enforcement of these regulations?

Mr. Dow: A great deal must be left at all times, but this difference that I have called attention to is essential. It means that a uniform rule—that is

to say, uniform in time; I do not ask that your rule be different in one property from the other—that the ultimate responsibility for regulation will in extreme cases fall on both, is true, but I submit that a company making a certain development should, according to the character of that development, be required to remedy a condition resultant to or aggravated by that development, to the extent of its ability before another company which has carefully avoided aggravating that condition or producing that condition should be required to furnish any remedy. That is the only point I make. The thing turns upon the essentially different character of two developments, one increasing the cross-section, the other reducing the cross-section. That is the point that I bring before you.

Now I submit that these works need not be discussed by name. It would be better if they were described in general. That a rule stating that diversion works, so-called, should be cut off, in case of low water, before interception works were required to close their gates, would be in order; and conversely in case of high water, the intercepting works should be required to close their gates before the diversion works, which would remedy that case in the natural course of their use, should be required to do so.

I may say, gentlemen, it is fair to refer to your original rules. May I see a copy of the rules of the Secretary of War?

CHAIRMAN ERNST: Well, these others are under discussion now.

Mr. Dow: I may say that there was in those rules one rule under which the Secretary of War required—doubtless within his authority, I do not question it,—that in case of high water the Lake Superior Company should open gates and relieve the high water. Now I have always felt, personally, and a corporation you know has no feelings and no soul and I cannot speak for my corporation in that,—I have always felt in that that public duty was imposed upon a private corporation in requiring that they should provide a remedy for the overflow, for the excess waters of Lake Superior, remembering that anything they had done, so far as I understand the case, tended to relieve that condition and not by any means to cause or aggravate it. Now, they have never been required to do so and possibly they never may, but I felt that in that instance a protest on their part would have been just as much in order. With our works extending now to the point where they may tend to cause high water, to ask the Lake Superior Company, under that existing regulation or under any substitute therefor, to open its gates equally with ours, to open flood passages equally with our opening of flood passages to relieve that high water, would be virtually to impose upon them the relief of a condition produced or aggravated by our works. Equity would be, I think, that in case of high water we should be required to give the extreme discharge possible, a discharge at least equal to the natural discharge, before they, whose operations tend to keep down high water, should be required to go out of the ordinary course of their operations.

You see the thing is absolutely equitable; it does not call for favouritism; and I refer you to the older rule under which I think, had I been in their place, I should have been inclined to make argument exactly as I have made argument here, that it was not fair, after a corporation and its engineers have absolutely prevented their works from in any way producing a certain condition, that the duty of remedying that condition should be placed upon them, and then, particularly so if the works of a co-user of the water tend to produce or to aggravate that condition. I think the fellow who helped to make the trouble should go to the extent of his power to remedy it before the man who kept clear of that particular trouble should. Conversely when the trouble is the other way, the shoe is on the other foot, gentlemen. And equity requires that this rule be not a rule operating simultaneously on all properties but that it differentiates between properties

of the two classes, properties which sluice water by diversion into new channels equal to increased cross-section, properties whose method is to intercept water in the flow and the closing of whose gates will be equal to the reduction of cross-section.

COMMISSIONER COSTE: May I ask you, Mr. Dow, how you propose to increase the discharge at your works in case of high water?

Mr. Dow: We do not in any way expect to increase the discharge at our works. We do not know that we can do so. The condition is that we may, in case of high water, open our gates to the extreme limit and open our spillways to the extreme limit and thereby provide a discharge equal to the natural flow, so that the condition of high water will not be produced or aggravated by our operations. On the other hand, the condition of low water, in closing our gates, will tend to assist that. Now, just the reverse is true in the power canal in condition of high water, the opening of gates will relieve it and the closing of gates will tend to establish normal conditions.

Understand, in answer to Mr. Coste's question as it seems I did not make it clear before, it is our intent to furnish in those works, either by the lifting of gates, letting wheels run free or otherwise providing an ample discharge to the wheels and by spillways in addition, the possibility of maintaining the natural regimen of Lake Superior. We wish to avoid very carefully the establishment of a possible injurious condition of high water. Just because we are doing those things we will therefore be able, incidentally to our works, or if those works should be taken and used in case of emergency for remedial purposes, we will be able to assist in remedying a condition of low water, but we will be in no position either to cause or aggravate high water or to remedy that condition if it should come from natural causes.

CHAIRMAN ERNST: We understand your point.

Mr. Dow: Yes, you understand that. And, of course, the converse is true of works of a different class where new cross-section is opened.

CHAIRMAN ERNST: Is there any gentlemen from the Chandler-Dunbar Company who will now speak?

Mr. JOHN H. GOFF: I feel, Mr. Chairman, that I could not do justice to the commission and to myself, nor to the rules, if I were compelled to speak just at the moment. I have not had the time to go over them, and you desire specific objections, if there are any, to those rules. I would like to have a little time to get the specific objections in such form that you would say that I was not consuming your time unneeessarily. I think that if I could ask your indulgence until we had conferred a little bit, perhaps I could shorten up the time that I would take.

CHAIRMAN ERNST: Yes, sir; there is no hurry.

Mr. GOFF: I really do not wish to talk here without purpose, and I think we can eliminate some by conferring. I see that there is one rule that I would like to make objection to at the proper time and there will be more, but I would like to have a little time, if your Honours please.

CHAIRMAN ERNST: Mr. Rowell, of the Lake Superior Power Company, are you ready to give us your views?

Mr. ROWELL: I am just in the same position, Mr. Chairman, as my learned friend, Mr. Goff. We have glanced over these hurriedly but I have not had time to discuss them with our engineer yet and I think it would be saving time

of the commission too if I could defer what I have to say, which will be very brief in any case, until we have had an opportunity to consider a little more carefully the rules handed to us this morning.

CHAIRMAN ERNST: You understand that they are essentially, so far as the regulations, operating the works, they are essentially what are already in force, which apply only to one company. Now these are extended to all the companies, both sides.

Mr. ROWELL: That is true, as I understand it, of the rules, Mr. Chairman, but the regulations.

CHAIRMAN ERNST: The regulations are what I am referring to.

Mr. ROWELL: At least that is true, as I understand, in regard to the regulations. The rules, however, raise matters of very great importance to the companies concerned and I feel it would not be justice to the companies or the commission that I should, without discussing them with our engineer, speak upon them.

CHAIRMAN ERNST: The Michigan-Lake Superior Power Company is represented by Mr. Shaw. Is Mr. Shaw ready?

Mr. SHAW: Unfortunately, gentlemen, I am in the same position as the brothers ahead. I am not an engineer and I could not pass upon these.

CHAIRMAN ERNST: How much time do you gentlemen want to get together and discuss these matters among yourselves?

Mr. SHAW: Why, I do not know, I am sure, until we do sit down. Of course, they are new to us, the rules are, but if there is going to be a session this afternoon I think that we might take up the other question, but anything on those specific rules would probably be better put off until that time, if the commission could do that.

CHAIRMAN ERNST: Yes. Well I will submit it to the commission.

Now, Mr. Goulder, you are representing the Lake Carriers' Association?

Mr. GOULDER: No, I do not, Mr. Chairman, in this. Mr. Livingstone, the President of the Lake Carriers' Association, is here to speak for them and with the action of their committee taken last week.

CHAIRMAN ERNST: You do not wish to address the commission at all?

Mr. GOULDER: I shall, in another capacity, but we would not both speak for the Lake Carriers' Association.

CHAIRMAN ERNST: Yes.

Mr. GOULDER: Either one of us is quite competent to speak for one association and Mr. Livingstone is the man to do it.

CHAIRMAN ERNST: Are you ready, Mr. Livingstone; we will hear you then.

Mr. LIVINGSTONE: Mr. Chairman and gentlemen of the commission, at a meeting of the executive committee of our Lake Carriers' Association held last week, the following resolution was adopted, a copy of which is addressed to you and we will leave with you.

'At a meeting of the Executive Committee of the Lake Carriers' Association, held in Detroit, Nov. 2, among other matters, the question of conditions at the Soo were fully discussed, and it was the unanimous opinion of the Executive

Committee that the best consideration for the safety of navigation interests would seem to require that the Weitzel lock be continued in operation, and that the proposed new lock be built north of the Poe lock, and that, with the very rapid increase in business, every effort should be made to furnish this additional lock for service at the earliest consistent time.

Also, seeing the very quick necessity of the further development of the Government works at the Soo to take care of this increasing navigation, we view with alarm any encroachment upon or other use of the land and water north of the Poe lock than may be required for its full and best utilization for the navigation interests.

Once before the matter has been brought to the attention of Congress, resulting in the law granting a right to a power company, but which carefully safeguarded, for the present and the future, the interests of navigation, which we believe should be paramount to such an extent that anything which even threatens the navigation interest must be considered with extreme care. We therefore, request the International Commission to take up this matter of further encroachment at the Soo as rigorously as it was taken up by the Rivers and Harbours Committee in the former case, and that every safeguard be thrown about any use, present or prospective, of the waters there, even to insisting, if that seems necessary, upon the stoppage of work and suspension of licenses until the matter shall have received such careful consideration by your Commissioners.

Briefly, the position of the Lake Carriers is this: I have listened with a good deal of interest to the discussion here as far as it has gone. I am not engineer enough, I know so little about the engineering side of it as not to be at all competent to discuss that question, but I want to put the Lake Carriers Association broadly and unequivocally on this plan and that exactly describes our platform, so to speak. We feel, first, that the navigation interests should be paramount to all other interests; that no private interests of any kind, name or nature should be considered for a moment in the use of which or by which or by any permission that could possibly be granted them that there is even the remote possibility of navigation interests being jeopardized to the slightest extent; that if there is the question or the possibility of a doubt that the granting of permission to any company, regardless of what its name may be or whomsoever represented by, that the depth of water could be diminished the fraction of a thousandth of one per cent, we are absolutely, utterly and unequivocally opposed to it.

It is useless for me to tell this intelligent commission of the great growth and increase of the commerce on the lakes here. It goes without saying that you are all well informed that the tonnage, the new tonnage put on these lakes alone in the last ten years, amounting to about 7,500,000 of gross tons, amounts to more in that short space of time than the entire tonnage of Lake Superior ten years ago. In other words, the increase in the last year-and-a-half in tonnage on the lakes, amounting to 7,500,000 tons, is greater than the entire commerce of Lake Superior ten years ago. I was making the computation the other day and I feel justified in saying that the commerce which would pass up and down Detroit river this year, 1905, will amount to at least 60,000,000 of tons; my judgment is that it will go over that sum, which will break all records. When it is taken into consideration that the commerce on the lakes here is practically a fraction over one seventh of the entire commerce internally in the United States—we have, roughly speaking, say 210,000 miles of railroads, costing $13,500,000,000, the average freight on the lakes, as you gentlemen are doubtless aware, is only a fraction over one tenth the average freight on the roads, and when you take into consideration with that that the reduction of even one mill per ton per mile on the carrying of freight would run into the millions of dollars, it can be readily seen that a branch of commerce that benefits almost every man, woman and child in the United States, that no private interests, no corporate

interests—I do not use that in any offensive way, but it is necessary to have corporations—should be considered for a single moment, and naturally when any question comes up regarding the water levels of these lakes, whether at the Soo or elsewhere, we naturally view such question with apprehension, and we feel that whatever is done, in case anything should be done, and I think I voice the unanimous feeling of our association when I say that we feel that no matter what is done, no matter what safeguards are thrown around it, we feel that it should be absolutely and entirely in the control of the Government, that in case we have any question about anything we do not feel that we should be compelled to go to any private individuals, to be driven into litigation, but that the Government engineers or some other body having absolute power, representing the strong arm of the United States Government, with absolute power to say 'thus far shalt thou go and no farther', should control the situation, is the position we take on the matter and is precisely the way that we feel about it. Our experience in the past has been somewhat unfortunate in some things. Many things apparently innocent in themselves have come up, obstructions have sometimes been placed in the waters and the result has been that it has taken a long time and sometimes years of litigation to get them removed, and we naturally prefer to lock the barn door before the horse is stolen and not afterwards. As I have said before, I am not engineer enough, I pretend to know nothing about that branch of the subject, to argue as to whether this method or that method is the best. This commission, I take it, with its engineering ability and skill which it is supposed to possess and undoubtedly does possess, in the care with which it was selected, we regard as entirely competent, of course, to make recommendations that will protect us, but I again repeat, in the broadest and most unequivocal way, that no private interests should be considered for a single moment where there is the slightest possible question that it would in any way influence the water levels of navigation.

I may say in this connection that possibly when these gentlemen get through, with your permission I may like to say a word or two more perhaps, but I merely wanted to define, beyond the shadow of a doubt, the position of our Lake Carriers' Association.

Chairman Ernst: Mr. Rogers, the president of the Tonawanda Iron & Steel Company, would like to say a few words to the commission.

Mr. Rogers: Mr. Chairman and gentlemen of the commission, I have taken the liberty of coming before you to speak a word with the view of asking your honourable body if you will take cognizance of a matter which I see is under pretty general discussion here and which has been brought to my attention as something that is likely to affect the level of the great Lake Superior and to that extent injure commerce. Of course, you will recognize that there is a certain selfish interest which I have in appearing, that consists in the interests which I have in the two companies controlling some fifteen vessels, but I hope you will give me credit for rising above that and having the broader feeling of interest in the vast commerce which is of such great value both to Canada and the United States. I am not very well posted on the contour of the ground at the Soo but I understand there is a company or set of gentlemen who are desiring to erect some works, most admirable in themselves and which I think none of us would wish to throw a straw in the way of being carried out to a successful conclusion in building up the industries at the Soo, provided it can be done without injuring the public in general and commerce in particular. Now, the point that I would make, the only one that have appealed to me is that the ground on which they are proposing to build is ground which very shortly, quite likely in the near future, the United States Government is going to require for extending the lock facilities, at the rate which commerce is growing, and we see that there is nothing

to check it, possibly not at such enormous percentages as in the past, where it has doubled in single years, but at the rate it is growing it is evident to those who have given any thought to the subject, that the Government must require before long further lock facilities, that those that exist there will not properly take care of the traffic of the lakes. Now, as I have studied the question from maps only, not on the ground, I understand that between the river and the Poe lock is the only favourable opportunity that the United States Government could have of building an additional lock and that these works if built there must necessarily occupy a portion of this land or must cover the land where such a lock would have to be built and its approaches, banks and so on, be placed. Now it would seem that we ought to look far enough ahead to prevent extensive improvements going there which later might have to be condemned and the Government called upon to pay the expense thereof.

The other point is an engineering proposition which I am not entirely familiar with, but I understand they are proposing to throw out a wing dam into the river. These facts probably have been mentioned before I came in; I am sorry I was not here earlier to hear them. And in that way they will require a cutting out of the lip of the basin, so to speak, of Lake Superior in order to bring to them, to their forebay, a sufficient volume of water to operate the water wheels that they are proposing to put there. That, I think is a self-evident statement, that anything that would lower the rocky bottom of the lake, where it discharges into the St. Marys river, would lower the level of the lake, and it is not necessary for me to add anything to what has been said by the speaker before me, what a vast detrimental effect such a happening would be.

I think, in brief, and very poorly expressed, those are all the points that I would have to make; that we ask you to safeguard the interests of the people and of the commerce of these Great Lakes by at least looking into this matter and advising yourselves fully of it and seeing that nothing is done which will in any way interfere with commerce or will be detrimental to the general interests.

Mr. Dow: Mr. Chairman, if the matter just before is fully in order I may take three minutes to furnish the facts, in case it may possibly put Mr. Rogers' mind at rest, and I hope it will put the minds of a great many more people at rest who are unduly agitated along the same lines. The development proposed up there is the development by the Edison Soo Electric Company, of which company I am president. It is in the river, north of the Poe lock. The plans of that development particularly and specifically include the abandonment of the existing power house now on the ground, required by the Government for a third lock. In other words, the proposal does not include the obstruction of the ground which plans of the third lock contemplate to use, but contemplates the actual clearing and transfer to the Government of that ground. Therefore, there is not an additional expensive construction to go on the land but there is to be the absolute removal of the present construction. That is part one. Part two is, that in addition to the land which the plans for the third lock require, there is left between our present development room which apparently is good for two more locks, and, as stated earlier in this discussion, it is not the fault of my company that there is not room for three more locks but the fault of legal technicalities which I wish we had been able to brush aside, I think an engineering commission would have brushed them aside promptly. That, I think, disposes of the question of the fear, and it should dispose of the fear of there being expensive constructions and rights, &c., established in the way of commercial developments. I ask credit, gentlemen, for taking great pains to leave room not only for the immediately required lock but for all the locks that even if the startling growth of commerce that Mr. Livingstone

has pointed out to us continues are likely to be wanted for the next twenty years; I am sorry it is not thirty years, it is not my fault.

Now, as to cutting out the lip of the basin, as Mr. Rogers expresses it, that is also something that we have very carefully avoided doing. To cut out the lip of the basin would, as an engineering proposition, permit us to assist in remedying not merely low water in Lake Superior but high water in Lake Superior and to that end might help navigation, but inasmuch as it was no part of our plans for the development of that power to cut out the lip of the basin but merely to take the water at a point one thousand feet down the slope, below the lip of the basin, to a point where nothing we could affect the amount spilled over that lip, we did not think it necessary and do not think it necessary at present to suggest the cutting down of the lip. I therefore wish to assure Mr. Rogers—in fact the plans in the hands of this commission will, I think, assure the commission—that nothing of the kind is contemplated, absolutely nothing of the kind and, therefore, he may be at peace, not only for the present but possibly for a good many years to come. I hope that some other engineer, when the question of making room for more locks is in order, will be present to represent this, and not myself. I shall then have lived fully my allotted time and have quitted engineering and other troubles.

CHAIRMAN ERNST: Mr. Livingstone desires another word.

Mr. LIVINGSTONE: Pardon me, gentlemen. Some questions have been raised here within the last two minutes. I did not want to take up unnecessary time apart from placing our position before the commission, but Mr. Rogers suggested one or two things which I had in mind to say later. As Mr. Dow has raised the question of the locks it occurs to me possible this is the best time to call your attention to it. As I have said before, I do not care to discuss the engineering side of it at all or attempt to, but I want to call the attention of this commission to this fact: The Canadian Soo lock, which is 900 feet long and 60 feet wide, was opened to commerce ten years ago last September; in other words, has been in commission about ten years. At the time that lock was built it was figured by good, competent engineers, at that time, and men well posted in the commerce of the lakes, that that would be sufficient for at least many years to come, if not perhaps for all time. The result is that we find in the short space of ten years that a boat has already been built, and others projected, one boat is launched and almost ready for business, the 'William G. Mather,' that is 60 feet beam and consequently unable to go through or use the Canadian Soo canal. The Poe lock when it was constructed was 100 feet wide and 800 feet long. When that lock was built it was figured that four vessels could be locked through at one time in that lock. At present we have, I am within bounds when I say now over fifty vessels on the lakes here that only one of these steamers could be locked through at one time. The Weitzel lock, we find on careful examination and calculation—I will say, premising my statement about the Weitzel lock, the United States engineers in charge of the work, in figuring over the possibility of greater lockage facilities which are very sadly wanted, they had some thought of building a new lock on the site of the Weitzel lock. I do not speak by absolute authority but from impressions which I have had in conversation with the engineers, and I think my belief is well founded that they have practically abandoned any such ideas as that and in fact our Lake Carriers' Association, as an association, would and did protest against it. We find that the Weitzel lock, although very much smaller than the other lock, that owing to the very large amount of tonnage which passes through, particularly lightbound vessels, not drawing the depth of water that downbound vessels do, in the majority of cases, that about fifty per cent of the vessels have been locked through the Weitzel canal. So that

in case that particular site were taken it would result in putting that lock out of commission entirely and we then would be entirely dependent on the two canals; that is, the Poe lock and the Canadian Soo lock; and in case of any accident occuring to any or either of these we would practically be out of business. November 9th or 7th, I am not sure which, for instance, the Poe lock would be closed for thirty hours on account of putting oil instead of water to operate the gates. That would leave us, in case we had but one lock, entirely dependent on the Canadian Soo, or *vice versa*, as the case might be.

We deem it of the utmost importance, when the engineers are figuring on that at the present time, that a new lock should be built on the north side of the Poe lock at the earliest possible minute, and that that lock should be completed at least before anything is done at the Weitzel lock, and that in addition to that we should have still another lock. With the great demands, with the feeling that long before these locks can be completed that the commerce of the lakes will have grown way above and beyond them, only adds intensity to the feeling that we have in viewing with great apprehension anything which tends to encroach upon the flow or discharge of water that would in any way affect the levels at these points.

You will pardon me for calling your attention specifically to it at this particular time, which I thought would be later, but it is on account of the remarks made by Mr. Rogers. And I will say this, that personally, I ought to say that all agree with me in that, I fully agree that the time has arrived now when at least the majority if not the whole of us feel that all that property ought to belong to the United States Government, that it will be needed, that the Government ought to own it and they ought to control it. As to how they ought to acquire it, that I do not pretend to say at the present time, but that every foot of that land will be needed for the commerce of the Great Lakes on the near immediate future goes beyond the possibility of a doubt.

CHAIRMAN ERNST: Mr. Goulder, will you favour the commission?

Mr. HARVEY D. GOULDER: Well, Mr. Chairman and gentlemen, I do not care to go into the specific rules. I want to say some things, however, about the progress of events in the past five years at the Soo. The lake interests were confronted with a proposition to divert a large quantity of the flow of water over the rapids and it filled the vessel men with dismay. There was a very earnest effort to see that if it did occur at all it should be surrounded by such safeguards as should make it absolutely incapable of injury to the lake interests and the thought of the lake men was, as Mr. Livingstone has expressed it in the homely saying of locking the stable after the horse has been stolen. The lake interests, the navigation interests, did not wish, as it was urged then and I here urged this morning, as I understand Mr. Dow's argument, they did not wish to have something put in there to try to experiment and then remedy the injury if it occurred. So, therefore, the Rivers and Harbours Committee required that the people who proposed to divert the water should be put under obligation by law to put in remedial works which should be entirely satisfactory to the Government engineers and also to guarantee the sufficiency of those remedial works by agreeing that if at any time it should be found that levels of the safe navigation of the Soo, that part of our waters was being affected, the Secretary of War or his representative could go in and stop the flow of the water, in whole or in part, and that even for a mistake of judgment on his part, or for any cause arising out of this action, there should be no claim for damages. Now, not only was that made, as I said, but this further was put in, that they should not impair the water or the navigability either as the works are there now or were at that time or as they might be made by the Government or as any new channels might come in, made by the Government, or, not having

then any international method of directly reaching the question, as they might be affected by any other works, no matter who put them up.

Those were the precautions that we took at that time and I know that the navigation interests then regretted that a company had come in, or a series of companies, I do not know many—because the personnel of the companies is nothing to the men—but we regretted it that they would be permitted to come in at all and spend a whole lot of money.

Now, with that law, which you will find in the River and Harbour Bill of 1902, with that law the thing was safeguarded. Now we come, the lake men, as individuals, and as they have expressed to you here through Mr. Livingstone as an association, they come along, I have clients who came along and have spoken to me in their private capacity, and I think it is fair to this commission to say that I have been offered a retainer in this case by the old or the existing canal, which I have not accepted yet, however, I don't know whether I am going to do it or not, because I want to feel free to speak for my clients generally and in my individual capacity and not as a paid counsel.

Now, I happened to be at the Soo and I looked over the situation, I saw what Mr. Livingstone has spoken of, I saw the great use of the Weitzel canal, and I talked with the men operating up there, talked with men located there, a tug manager, with the managers of several steamboat lines, and so on, and I became convinced perfectly myself of this, first, that the Weitzel lock ought not to be disturbed, at least not until after the other lock has been built on the north side. I became convinced that there is an absolute necessity to-day for widening the canal, even with the locks that we have got, and that those locks cannot be operated with the present canal when we have a new lock, either an increase in the size of the Weitzel or a third lock north of the Poe lock.

You find up there, when there is a wind from the westward and they fill the big lock, that the water is liable to run over and make such a current in that canal, that the water runs over the head gate of the Weitzel lock. I am not much of an engineer but I saw that and men called my attention who are somewhat engineers.

Now my own personal notion was formed also on this: That there is a great big hole being dug out there in the rapids; there is necessarily a change of the currents; and I want to say that my alarm was increased this morning by hearing the representative of this new concern, the Chandler concern, speak upon a matter so vital to our country and the prosperity of this country as is the free and best communication through that river and through those locks, of how there should be gotten up some rules based upon these things: that one kind of improvement, one kind of use would have a certain effect with reference to lowering water, that another kind would have a certain effect with reference to raising water, and that there would be one playing over against the other and that the duty of this commission would be, and the responsibility of this commission would be, to get up a set of rules by which the varying plays upon that water would be corrected, this way or another way, according to the character of the works; and the gentleman who spoke said that rather than name companies it would be well to describe, use words of description, that a certain kind of use of the water should be subjected to a certain kind of rule. And this alarmed me I am free to say, that there should be some order in which one company or the other company should be required to deal in respect to regulating works, all having reference to fluctuations of the water.

I have no hesitancy, from what I have seen of the thing, what I have heard of the thing from men who do know, in an engineering way—and, of course, I do not intend to speak to this commission about the engineering features—but I have no hesitancy in saying this: That the Government of the United States and the Government of Canada ought not to permit things to go into those rapids

which should have to become the subject of that kind of rules. I am not sure that it has not been a great mistake to permit the canal that is now operating in part. I do, if I know anything as a lawyer, believe that the law under which that is being operated makes it safe for the United States.

Now, my judgment about the thing—and it is judgment, gentlemen, and not opinion, because I am not competent to give an engineering opinion—but my judgment is that these people who have gone in there with an enterprise ought to be very fairly treated, and we all acknowledge that navigation interests ought to be just as fair with them as they were with the other, but that has not progressed very far and I believe that we will regret; I believe that people who are now and shall continue to be interested, those who shall come after us, will regret any action which permits the taking up of that water any further.

As a matter of judgment on the engineering question, I think that what the Government of the United States should do, what I think I should do if I had a contract to put vessels through, and with the prospect of an increasing business such as we all see up there, I think I should corral that water, I think I should put out a big dam, in which there would be no private interests whatever, absolutely in the control of the Government and in the operation of the Government, and that there should be a forebay so that you could fill those locks. If I live to the allotted span I expect to see four locks up there instead of two as we have now on the American side, and which you can fill from a forebay, by subterranean passages, and avoid current in the canal and do your work more quickly. I think you are going to come to this, I think you are going to be confined more and more to the lockage of a single ship, and that for the reason that when you crowd in there it takes too long for a lockage.

I stood on the pier and saw this: I saw a large ship and two smaller ones that pretty nearly filled the Poe lock; there were simply interstices between those two ships and the walls, and when the ship went out—how large is the 'Sonoma,' Mr. Livinstone, about an eight or nine thousand ton boat?

Mr. LIVINGSTONE: Yes, about that.

Mr. GOULDER: Not one of the largest, quite?

Mr. LIVINGSTONE: Not one of the largest. It is nearly 9,000 tons, 54 ft. beam.

Mr. GOULDER: Now that boat, I think I am quite within bounds in saying that she took twenty minutes to get out of that lock because they had to heave her out. In that condition they could not use her propeller wheel. The next vessel that came out was a smaller one and they had to heave her part way out of that lock before she could use her propeller wheel, and then the third ship that came out last came out with the use of her own wheel, without heaving. And we are building now two ships 600 feet long. I heard a man say the day before yesterday, and the man is Mr. Wilkinson, of Syracuse, the manager of—how many, fifteen, sixteen, large boats?)—

Mr. LIVINGSTONE: Manager of the United States Transportation Company. They have got about fourteen boats.

Mr. GOULDER: I heard him say that he was ready to venture the opinion that before we get through with this lake navigation, and I think he said within twenty years, he really expected to see a ship come down carrying 25,000 tons.

Mr. LIVINGSTONE: He has been an optimist.

Mr. GOULDER: Well, I have heard a man very high in the American Ship Building Company predict a ship 700 feet long and 70 to 75 feet beam. I heard

a very prominent vessel man, Mr. Colby, the other day say that he really thought they had got to the limit in 600 feet length, and, say, 60 feet beam. And *there* are your opinions.

CHAIRMAN ERNST: Where is that ship being built, 600 ft. long?

Mr. GOULDER: Where are those being built, Mr. Kelley; at Chicago?

Mr. KELLEY: South Chicago.

Mr. LIVINGSTONE: One is going to be built at Wyandotte also. They are going to be built by the American Ship Building Company. 600 ft. over all and 58 ft. beam.

Mr. GOULDER: And on the draft of water we have had this year they will carry 12,500 tons, gross tons, of ore.

CHAIRMAN ERNST: Are those ships under contract?

Mr. GOULDER: Yes, sir, they are building four, the Pittsburg Steamship Company, and built by the American Ship Building Company. The American Ship Building Company has several yards, I suppose when they get to turn off a certain ship will lay down her keel at the most available yard they have.

Mr. LIVINGSTONE: They have just completed four, their length is about 580 feet over all.

Mr. GOULDER: 569, I think those four are, over all.

Mr. LIVINGSTONE: These two now will be 580 over all, 58 ft. beam and 32 ft. hold.

Mr. GOULDER: The 'Wolvin' is 560 ft.

Now you have got this to consider. The last River and Harbour Bill I think went through the same proposition, and in 1880 or in 1881, I think that was the year when they called for the survey of a 20 ft. channel, I think it went into the last River and Harbour Bill to have a preliminary survey to estimate the cost of channels 22 ft. deep, also of channels 25 ft. deep. Do you know, Mr. Wisner, whether that went through?

Mr. WISNER: I do not. I think it did though.

Mr. GOULDER: Now this we may have in mind and any of you engineers can correct me on technical matters. When they built the 'Wolvin' she was 32 ft. in depth, 560 ft. over all, and, I think, 56 ft. beam. Our terminal machinery around the lakes is adjusted so that it is somewhat difficult to handle mechanically the cargoes where the ship is more than 56 ft. beam. There has been some question in this boat that the Cleveland Cliffs are building, whether they will not be somewhat handicapped until there are changes in machinery, by having a boat 60 ft. beam, but also the length is circumscribed by the engineering belief, engineering opinion, that to go over 560 or 570 feet in length you ought to get a greater depth. The 'Wolvin' had trouble by reason of her depth. They had to list her over at elevators and ore docks and coal docks, &c. Now they have stretched a little. They are building these two 600 ft. ships, as I understand it, 32 ft. depth, with a length of 600 ft., and I think they feel that that is about the limit. But of course we do not want to make our ships higher because there is all that dead weight to carry in lieu of cargo, but when we get 22 or 23 or 24 feet on the lakes, or even 25, for which there will be an earnest endeavour, then we can build our ships deeper and we can build them longer and being built longer they will be built wider.

Now there is the practical condition in which we are. I want to say that I agree with the resolution which Mr. Livingstone has read to you. I also view with alarm any encroachment upon that land out there or any permission

whatever to use that water, and I think that if the Government of the United States has not a title—I understand that that is in litigation; if the United States Government has not the title, it seems to me that the United States Government ought to get the title and it ought not to put it off and there ought not to be any complications. If those gentlemen who are working there own that property they should be paid for it and they should be paid a good reasonable price.

Now, I think, from conversation that I have had with vessel men, conversation that I had with men up at the Soo in the presence of this, I think you will find that not only vessel owners but the ore men, the coal men, the grain men generally, would very deeply regret any use of that water further except for navigation purposes, and I, speaking personally, sincerely hope that the commission, with every disposition to do perfect and complete justice to those gentlemen, in the matter of title and price, will very, very earnestly consider whether we dare, in the face of the increase that we have seen, the increase that is promised, whether we dare do anything except to hold that which is really the key to the situation.

Now another thing that threatens. It is claimed now, I believe—and you gentlemen ought to know better than I about that—that when the West Neebish channel is opened it will reduce somewhat the level up there. If that is true when it does not necessarily mean the cutting away of a lip, it is the deepening of the channels which may have that effect. Now I do not pretend to know, I do not pretend to have any opinion about it. I simply have heard that. I think that Mr. Clinton, living right here in Buffalo, knows of the difficulties they have had here at Buffalo in getting a channel, the effect there of cutting in the rapids abreast of Buffalo.

Now to my mind, those things have got to be handled with wonderful care, and we were, I can assure you, extremely gratified when we found that the International Commission was appointed so that we, near neighbours as we are, could get together on these things and find out what is best for all of us. There cannot be anything good for us that is not good for the Canadians, or *vice versa*.

And we are hoping this, if you will pardon my diverging a moment to this point, we are all hoping that this commission will give a broad construction to their powers, and I think that you may depend upon the navigation interests; I think, Mr. Livingstone, for the Lake Carriers' Association you could say that in all probability the whole lake navigation interests would be behind the commission to strengthen their hands and broaden the scope of their powers as much as possible.

Mr. Livingstone: Oh, unquestionably.

Mr. Goulder: That is about the feeling. Now, gentlemen, I have detained you perhaps too long already.

Chairman Ernst: Much obliged to you, Mr. Goulder. Will Mr. Kelley favour us?

Mr. Kelley: Mr. Chairman, I ought perhaps to explain what interests I represent, although it is sufficient to say that they are identical with those which have been so ably represented by the two last speakers, the President of the Lake Carriers' Association and its general counsel. I represent in a professional capacity the Pittsburg Steamship Company, the Cleveland Cliffs Iron Company, the Wolvin Fleets, usually called the Wolvin Fleets, and some others, comprising perhaps altogether 200 of the largest vessels on the lakes, and, in addition to that, considerable iron interests in the shape of mines in the Northern Peninsula which

are obliged to find their outlet through the Soo river, and in addition to that, furnace interests which represent the other end of the iron interests, which are fed through the Soo river. I do not intend to take much time of the commission because I think the subject has been covered in a general way more ably, better, than I could cover it.

There is one phase of the matter to which I shall address myself almost exclusively. I think we all agree that the safeguarding, not only of the water levels of Lake Superior and of the Soo river in the neighbourhood of the Soo canal, but that the safeguarding of all the future needs of lake commerce, is one of the problems before this commission. I noticed that the first speaker who addressed you in connection with this subject, the representative of the Tonawanda Iron & Steel Company spoke of the navigation interests which he represented as perhaps selfish ones. I do not so regard them. In a sense, of course, we want our vessels to succeed and our vessel company to succeed. Notwithstanding, as has been pointed out to-day, the interests of the vessel owners in this connection are really secondary to the great interests of the United States in the commerce of the Great Lakes, a commerce which is the only one, I may say, afloat belonging to this Government, in which we Americans can take a justifiable pride,—it feeds the East and it brings the products of the West, and it is, therefore, not selfish but national. We all agree upon this: We all agree that whatever is done at the Soo canals must take into account a great future growth. What that growth is none of us can foresee but we can forecast, to some extent, what it will be from what it has been, and judging from that it is not too much perhaps to predict that within the time against which we ought now to be providing, instead of forty-two it will reach two hundred millions of tons. It is not certainly going beyond the point which we ought to provide against to say, as Mr. Goulder has just said, that we may need and probably shall need at least two more locks on the American side at the Soo. Just when, we cannot say. One of them is certainly needed now. And that brings me to the point to which I wish particularly to address myself, and it is that portion of the resolution of the Lake Carriers' Association which was presented by our President. After stating unequivocally that they did not favour the abandonment of the old, of the Weitzel lock, but urging the immediate construction of a new lock north of the present Poe lock, the resolution goes on, 'Also seeing the very quick necessity of the further development of the Government works at the Soo to take care of this increasing navigation, we view with alarm *any encroachment* upon or other use of the land or water north of the Poe lock than may be required for its full and best utilization for navigation interests.'

Now the statement has been made by one of the parties interested in the development of the power works at the Soo, one of the parties, I believe, which has been obtaining or which has obtained some licenses which has already resulted in placing in the rapids, in fact I believe opposite land owned by the Government at the present time, works which are at least forerunners of an occupation of the rapids and of the waters north of the present Government canal, that the future has been safeguarded by a plan which would so remove the power houses as to admit of the introduction of one more lock or possibly two more locks, and the gentlemen regretted that it did not go further and leave still more room.

Now, like the gentlemen who have spoken before me, I am not an engineer but some things in connection with the operation of the Soo canal have come before my attention as a lawyer perhaps more forcibly than they would come before an engineer. One of those things is the danger to vessels by the present arranging of locks. The opening of those locks causes the current in the canal above, which to my certain knowledge has caused two quite serious collisions within the past year. One of these collisions resulted from carelessness on the part of the lock tenders in giving notice to two large steel vessels which were

above the locks, one of which was a helpless tow-barge, to let go their lines, and the tow-barge was in the act of shifting from the south pier to the north pier above the locks, in obedience to the orders of the canal officials, when the locks were opened, with the result that the barge was swept down toward the head of those locks, and I have always regarded it, in reading accounts given by the witnesses whose statements I took in connection with a collision between that barge and another vessel, as a wonder that that vessel did not go down through the Poe lock and carry everything with her.

The possibility of such a catastrophe will strike you gentlemen at once as calling for some very effective remedy. Whether that remedy can be forced by widening the canal above the present locks, as would have to be done if a new lock were built north of the present locks, is an engineering question with which I am not competent to deal. I have an idea, however,—

Mr. LIVINGSTONE: Will you pardon me, just a minute? You know Colonel Davis has already started to double the width of that and increase it to 108 feet, but I did not mention that because I thought it might perhaps be invidious in some ways, as far as personalities with which I haven't any connection at all, and that is held up at the present time, the canal above the lock widening from one hundred feet to two hundred and eight feet, on account of litigation between the Dunbar-Chandler people and the Lake Superior Power Company.

Mr. KELLEY: I am ignorant that there was any litigation. I hope all the gentlemen will give me credit for a due amount of ignorance in connection with the situation, as far as regards these selfish interests. I call them selfish because I think any private interest up there connected with power canals, whether it be one of these companies or the other that I understand are obtaining rights there, should be made entirely subservient to the great public interest of which I speak. I know nothing about the litigation. I am speaking now from my own idea of the thing, from actual experience with conditions.

This thing has happened twice, to my knowledge, within the last year, and the last time it happened I dictated a letter, which I presume was duly forwarded by the president of the Pittsburg Steamship Company, Mr. Colby, the officers in charge there, warning against that kind of carelessness. Whether that condition can be remedied by widening the canal above I am not competent to say. I must say, from the standards of a man who has had some experience with currents, in a general way, I should doubt whether the mere widening of the canal above the locks would be effective to obviate the difficulties, especially with four locks there. I cannot see why the opening of those two locks at once, with the canal of double the width that it is now, would not result in producing a current similar in its general effects to the opening of one big lock with the canal half the width. That would seem to command itself to a man's common sense. I do not believe from what I have seen of the operation of those locks, and from what I know of the currents caused above the canals by the opening of the locks, and the dangers to shipping and the dangers to canals—because we must take into account that a catastrophe such as was narrowly averted in the case of the barge of which I speak, would have blocked lake commerce. Such a catastrophe we must look upon with more than alarm.

Now I have seen it suggested—whether it is a feasible engineering problem I am unable to say. I mention it because it illustrates what I am going to say and I mention what I am coming to in order that the commission may see the force of this suggestion of the Lake Carriers' Association as I see it. The suggestion that I have heard made as to a remedy for this current, which is one of the difficulties under which navigation is now labouring, requires, would require the use in there simply of sufficient land north of the present locks to put in two locks or three, as the gentleman who has spoken here suggested he has carefully pro-

vided for, but would require the use of a considerable part of the rapids. The remedy suggested, as I say, may not be feasible from an engineering standpoint, and it is this, and foreshadowed by Mr. Goulder; that a forebay be constructed in those rapids, when the three or four locks are built, that an arm be run out into those rapids forming a forebay, and that the water which is to be turned into those locks to fill them be drawn from that forebay and be entirely divorced from the canals above through which navigation must proceed. In other words, when the locks are to be filled they are to be filled from water which has no connection with the navigable water above but which is drawn from an independent forebay built out into the rapids and fed to the locks in such form that it cannot in any way cause a current detrimental to navigation. Now, this is merely illustrative. It is not that I am advocating the idea of a forebay because I do not know anything about the engineering feasibility of it, but it illustrates the force of the Lake Carriers' contention as put forth in this resolution, that they view with alarm any occupancy of the river north of the present locks, or any occupancy of the river north of the present locks which will interfere with what is very likely to be required in the future by the interests of navigation.

As to the ownership of lands there, as to vested property rights, it does not strike me that these cut any figure in this discussion at all. If the United States Government, in the upbuilding of the American marine of the Great Lakes requires, or, in the exercise of a wide foresight, feels that it may require in the future, reasonably may require in the future the use of the lands north of the present locks or the use of the entire river north of the present locks, the right of eminent domain is open to it and at an expense which would be trifling at the present time or in the immediate future, before these lands and these rapids are occupied by expensive private establishment, all that future can be provided for, the Government can own that will almost surely be required in the development of this great national commerce of ours—because it is national, it is not sectional; it can acquire those things which we now foresee will be required.

And, I believe, gentlemen, in the past our foresight has not kept up with the actual condition of things. What a man would have predicted ten years ago would have fallen short of what has happened in those ten years. I see no reason to believe that what a man will predict to-day in the way of lake navigation needs, for the next ten, twenty years, will fall short of the actuality and what will come. Now, we, some of us at least, can foresee already, we think we can foresee the necessity of absolute government control of those lands north of the present canal locks, the necessity of absolute control of the rapids there, not only for purposes of lake level but for purposes of actual occupancy and use in connection with this lake navigation. The Lake Carriers' Association has given utterance to that foresight in this resolution which I have read, in which they say they 'view with alarm any encroachment upon or use of the land and water north of the Poe lock that may be required for its fullest and best utilization for navigation interests.'

Gentlemen, without going into a broad discussion of the general questions which have been raised here I wish, on behalf of the interests which I represent, I wish to urge respectfully that this commission give to this subject a consideration fitted with eyes looking far ahead, a consideration which will take into account what is sure to come, the necessity of the United States Government appropriating these very lands about which we are now talking, and if those lands carry with them—if riparian rights go with them, securing control of the rapids there, or at least not now going ahead and granting licenses permitting expensive improvements which will make appropriation at a later date, when it is sure to come, so expensive as to be prohibitive.

CHAIRMAN ERNST: Thank you, Mr. Kelley. Mr. Harvey Brown?

Mr. Brown: Mr. Chairman and gentlemen of the commission, I appear as the representative of various navigation companies and shipping interests of the city of Buffalo. In other words, I appear as a local man and for local interests. We realize, however, that our local business, our vessel business and our grain and iron and ore business, &c., have a relation to the larger business of the country, and therefore that we are directly interested in anything which affects the locks or navigation at the Soo, for the reason that we believe that to be the key to the whole lake transportation business and we believe that the happiness and prosperity of millions of our people on both sides of the border are dependent upon the lake transportation which furnishes the cheapest transportation in the world per ton mile. We believe that the growth and prosperity of both countries have been on account very largely of the cheap lake transportation. We know that you realize the growth of it as well as we do, both in the size of the ships and the growth of the commerce. We now know that you realize how the iron and steel interest has grown up on account of this transportation, that you realize that about eight per cent of the ore consumed in making iron in this country comes from our Lake Superior region and that the amount of it this year will be about forty-two million tons, and we call your attention to this merely to illustrate in an emphatic way, as we believe, the importance of that little spot at Sault Ste. Marie. Suppose that a catastrophe had happened there, say, the first of June of this year, and those locks had been swept away so that navigation through that canal was disturbed for this season of navigation —and it surely could not be repaired in the case I am assuming under a year or two—what would be the effect upon the country at large? It would be a financial panic and suffering hard to be conceived. Nothing short of a long and disastrous foreign war, I believe, could be thought of that would be as disastrous as such a catastrophe. There, we vessel men and shipping men see the key to this situation. We believe that now further facilities are necessary, we believe another lock is presently necessary, that in future others will be, as has been stated here several times to-day. We present this to you, gentlemen of the commission, to consider and ask that you consider broader rules and a greater situation than the suggestion first made of rules to govern these private corporations, to govern their use of the water. The raising of the level of the water a few inches or a foot is a very serious matter, but we ask you to consider this in a broader manner than that and see its effect upon these two great countries, and ask you to consider for the future. We as business men realize that governments deal with dollars and cents, that when it comes to an appropriation for further locks at the Soo the question of expense is very material. You realize as well as we do how hard it is to get an appropriation for such a purpose when there are so many asked for. As business men we look upon the situation there as this: private corporations which we see there—who they are we have no concern with—we see them working out into the waters there, expending apparently millions of dollars creating very valuable rights, and we see, as business men, that if commerce increases as we have every reason to expect it will, the Government will be asked to take those lands and waters and will be required to pay for them, and the millions that are being put in there now will be asked for from our Government for reimbursement, in addition to the millions which must be expended for the lockage. It, therefore, as a business proposition, makes it very much harder to get the locks that may be required there in the immediate future if millions are allowed to be expended. We therefore suggest to your Honourable commission that you consider whether the suggestions from business men are not properly made, that you consider not only such rules as are here proposed, but that you consider whether or not it is proper for this commission to advise your respective governments (and I think the recommendations of such a commission would of course have great weight with both governments,) that they forthwith stop further expenditure, stop granting licenses

to individuals to expend money there, and perhaps even withdraw the licenses which have been given; in order that you may take a broad view of the whole situation, consider what improvements in our day at least are likely to be required there for the great public navigation interests; and that before millions are expended by private corporations your consideration be given to what is required there in the future, that your plans be made for the future, that recommendations be made for the future; that we be not handicapped when the times come very shortly when we will have to ask for appropriations for locks for the additional commerce, for the increased commerce, through the Soo, that we shall not be handicapped by money expended by private corporations.

Chairman Ernst: I would like to inquire now how much time the gentlemen who wish to consider further those rules and regulations, how much time they would like to have. I have already submitted the question to the commission and the hour which we had in mind at that time for the afternoon session was 2 o'clock. It is now 12 o'clock. Will that give you time enough?

Mr. Goff: So far as I am concerned, Mr. Chairman, I shall be ready at that time.

Mr. Rowell: We will try and be ready at the same time, Mr. Chairman.

Chairman Ernst: We do not want you to try unless you have plenty of time. We wish to give you such time as you required. We want to consider this question from all points of view.

Mr. Rowell: Would you pardon me for a moment that I may speak to Mr. Shaw?

Chairman Ernst: Yes, sir.

Mr. Rowell (after consulting with Mr. Shaw): If, Mr. Chairman, you could say half-past two, perhaps we will be more ready.

Chairman Ernst: You speak also for Mr. Shaw, do you?

Mr. Rowell: For Mr. Shaw, yes, sir,

Chairman Ernst: Very well. The public meeting will be closed now until 2.30 o'clock this afternoon.

At 12 o'clock representatives of the various interests retired and at 12.15 the commission went into executive session, all of the commissioners being present and Col. Anderson presiding.

Afternoon Session.

Meeting called to order by CHAIRMAN ERNST at 2.30 P.M.

Mr. JOHN C. SHAW, of Detroit: I would suggest, Mr. Chairman, as Mr. Dow said this morning he put in part of his case and Mr. Goff was to put in the other, and as he may bring up something new, I would suggest, to save my speaking twice, as I might perhaps have to do, that they put in their whole case, let Mr. Goff proceed, and then I should like to take it up—if that is agreeable to the commission. Otherwise I will proceed.

CHAIRMAN ERNST: I do not think the commission has any objection to that arrangement at all if it is preferred all around, if it is a mutual agreement between you.

Mr. SHAW: No, but I simply suggest it as Mr. Dow said this morning he wanted Mr. Goff to be heard and that he only stated part of their desires and Mr. Goff was to put in the other—that we might have it all together instead of taking it piece-meal.

CHAIRMAN ERNST: Do you wish to speak now, Mr. Goff?

JOHN H. GOFF, of Detroit: Mr. Chairman, this is entirely on Mr. Shaw's motion. It is not any question of preference on my part. I was ready. If your honour had called on me first I should have proceeded, and I will now. I don't know anything about 'piece-meal' or anything of that kind, because we are not regulated here like we would be in some court or anything of that kind. I will proceed now if you say so. I have no objection to it.

Mr. ALEX DOW: I am also ready on behalf of the lessee company.

Mr. GOFF: I would prefer to speak then than to be put off to some time later when I might be shortened up, so if it is agreeable I will proceed.

CHAIRMAN ERNST: All right, if it is mutually agreeable we will hear you.

Mr. GOFF: I hadn't thought about it. I was waiting the direction of the commission.

If the commission please, I direct your attention to Rule 1. This rule reads now:

'Neither the government of the United States nor the government of Canada shall grant permits for the use of the water of St. Marys river in excess of one-half the natural flow less the amount needed for navigation purposes.'

Now the condition at Sault Ste. Marie, as we understand it, is this—I set forth now the respective claims as we understand them to be made. One of them is that the Michigan-Lake Superior Power claims the right or privilege under the Act of Congress of the United States, approved June 13, 1902, to divert through its water-power canal water equal to one-half the normal flow of the St. Marys river, and the Lake Superior Power Company of Ontario claims the right or privilege under an Act of the Parliament of the province of Ontario assented to March 23, 1889, to conduct through canals, flumes, &c., and to use for hydraulic power, all the other half of the normal flow of the St.

Marys river. It results that neither of these companies requires or is asking from the government of the United States or of Canada any further right or privilege in the sense of the wording of this rule; and inasmuch as these two companies are substantially one corporation, it results that their single corporation claims to own the right or privilege to use for water-power the entire flow of the St. Marys river.

CHAIRMAN ERNST: A claim is not a permit.

Mr. GOFF: I think that is true. Now, if the commission please, I take it that there is an intent here on the part of the representatives of the Canadian government and on the part of the representatives of the United States to divide this water so that neither one shall grant more than half of the natural flow less the amount needed for navigation purposes. That is, the water shall not be used by either government. The point is to establish what is equitable between the two countries, I take it. Now, if that is the intent here—and that is what I desire to know—why could not this rule be amended by simply striking out the work 'grant' and the word 'for' and changing the word 'permits' to 'permit'? I will read that as it then would stand with that amendment:

'Neither the government of the United States nor the government of Canada shall permit the use of the water of St. Marys river in excess of one-half the natural flow less the amount needed for navigation purposes.'

COMMISSIONER MABEE: 'Permit' what?

Mr. GOFF: 'Permit the use'—neither government 'shall permit the use of the water of St. Marys river in excess of one-half of the natural flow.'

CHAIRMAN ERNST: It is the same thing exactly. It means the same thing.

MR. GOFF: Then I understand that to be the intent that either form of expression is the same?

CHAIRMAN ERNST: The same thing.

Mr. GOFF: That is, they are identical expressions.

CHAIRMAN ERNST: Yes.

Mr. GOFF: Well, suppose one of them should claim that they already have permits and no further permit is needed?

CHAIRMAN ERNST: You need not suppose things that do not exist. We have not granted those permits. We have granted no permits for any fixed quantity of water.

Mr. GOFF: So that is what that means anyway.

CHAIRMAN ERNST: That is what it means.

Mr. GOFF: Turning now by way of preliminary remark to Rule 8, which I do not criticise, but refer to as introductory, that rule reads:

'Nothing herein contained shall be held to affect any existing riparian or other rights of any person or corporation, or the existing remedies therefor, or any action at law or equity now pending.'

There are other parts of the rule which I do not read. Turning now to Rule 4, you will see that there is a proposed division of the water. In other words, it is proposed, until plans can be submitted and reported on, that the Michigan-Lake Superior Power Company, now operating power works at Sault Ste. Marie, Mich., may use 8,500 cubic feet per second, no more; that the Chandler-Dunbar Company may use 4,000 cubic feet per second and that the Lake Superior Power Company of Ontario may use 7,000 cubic feet per

second, and no more. We are at a loss, representing the Chandler-Dunbar Company, to understand this proposed assignment of the cubic feet of water.

CHAIRMAN ERNST: If it was intended to grant about what the companies are now using, and the 4,000 for the Chandler-Dunbar Company turns out to be too great. They are not using that amount. The thing is somewhat in the air just now. No permit, as I said before, for any fixed quantity has been given. Permits to take water have been given and these people are using about these quantities. Now, in the first part of that we require that all plans be submitted and approved. In the meantime we do not want to stop their work, and for the time-being they are allowed these quantities. That is a rule that will expire by time as soon as the plans are approved.

Mr. GOFF: But the rule reads 'hereafter.'

CHAIRMAN ERNST : Yes.

Mr. GOFF: These corporations that have this division of power are already in existence and have already obtained rights.

CHAIRMAN ERNST: They have them subject to any regulations hereafter to be established by an International Commission which has only just come into existence. They have no rights which are permanent there at all; that is, no permits.

Mr. GOFF: Of course, you are not passing on that.

CHAIRMAN ERNST: Not upon their legal rights. We are trying to avoid that.

Mr. GOFF: Now, this in my judgment will set a precedent which we would not feel ourselves justified in omitting to protest against, for this reason. We object to this division, and as a basis of that objection I desire to touch a little bit upon the history of the corporation that I represent, as well, as this corporation which has been assigned 8,500 cubic feet. When the Act of Congress, which these rules seem to follow to a large extent, the act of June 13, 1902, was passed, granting to the Michigan-Lake Superior Company the right to divert water, it was expressly provided in that act that it should not affect the riparian rights of any other corporation or person. In other words, that grant was made to that corporation subject to the rights of the Chandler-Dunbar Water-Power Company. This new law,—it is not anything that we have to call upon your Honours to rely upon our assertions, however trustful you might believe us to be, but it is expressly stated in the act of Congress. Now, we had the right before any Act of Congress, under the laws of the State in which this Chandler-Dunbar Water-Power Company was exercising its function,—we had the right to the water out from the mainland to the international boundary line. We had all those riparian rights. I do not wish to argue anything in regard to intricate law points, but I desire to say that we held under a patent of the United States considerable land there, about 3,000 feet, along the shore, containing about nine acres of land, conveyed by a patent of the United States. So we had the right to have the water flow by our land as it was accustomed to do, and that right was preserved by the Act of Congress. So we are at a loss to know how, when it comes to the division of water-power, that they can take what they are using, and there is a limitation upon our right to use any more than 4,000 cubic feet.

CHAIRMAN ERNST: In other words, you claim that you are using now more than 4,000?

Mr. GOFF: I don't think we are, no, sir, but what I mean is, how long would this division continue? Where is the limit to this?

CHAIRMAN ERNST: Till those plans are approved.

Mr. GOFF: But that is in regard to any other corporation, some new corporation springing up.

CHAIRMAN ERNST: No, your corporation, all the corporations springing up there. They haven't been approved by this commission; their plans have not been submitted.

Mr. GOFF: Then I would judge of course that what the commission desires is all the suggestion we can make.

CHAIRMAN ERNST: We do.

Mr. GOFF: You will not consider it in any unkindly spirit if I press this a little bit. In the first place, this speaks about the future by the word 'hereafter,' and it speaks about 'excavating.'

'No corporation or person shall be permitted to divert the water or excavate any channel or erect any structure therein.'

Now, suppose they have the structures already in; suppose they have already diverted the water; suppose they have already made the excavation? This prohibition relates to the future and does not touch upon the present. So I submit that what should be done, if it is intended to cover the existing corporations there, is that that should be directed more explicitly toward them and even toward the excavation. You can easily see that the 'hereafter' is an important word there. 'Hereafter' relates to those three things, the diversion of water, the excavating of channels and the erection of structures. Those things, if anybody does them hereafter, he must go and get this joint approval; but what are the people going to do that now have the water diverted, the structures erected and the channel excavated?

CHAIRMAN ERNST: They must submit plans and have them approved for everything they have already put in or propose to put in.

Mr. GOFF: No, our rights are saved by that Act and they are also saved by law, the right we had long before the Michigan-Lake Superior Power Company came into existence or was conceived in the mind of man. We were operating a water-power canal there. We were not diverting the water off into the State of Michigan, but we were using it as it flowed by our land there—a little bit of a canal was run out there,—and we were protected in every way. Now, here is a limitation immediately. The Michigan-Lake Superior Power, taking its rights subject to ours, is assigned 8,000 cubic feet per second because they are using it now, and we are limited to 4,000, although we may in a very short time desire to use more. So I submit that there is not that regard and attention given to our rights under the law, although it is stated here that 'nothing herein contained shall be held to affect any existing riparian or other rights of any person or corporation'.

CHAIRMAN ERNST: We try to avoid that. We do not attempt to decide these questions of law.

Mr. GOFF: What I think about it is that that limitation there as to time is too indefinite.

CHAIRMAN ERNST: Am I right in this supposition, that that is two or three times the amount of water you are now using?

Mr. GOFF: Well, I don't know. I am not an engineer, as so many people have said here to-day.

CHAIRMAN ERNST: No, but you are representing them. What is the fact? Is that two or three times as much or not?

Mr. GOFF: I can't answer that.

CHAIRMAN ERNST: Well, I believe it is. I am told it is.

Mr. GOFF: I don't understand it is two or three times. I understand it is more than they are using.

CHAIRMAN ERNST: Well, about, a little over three times, I am told.

Mr. GOFF: I think that the engineer here can reply to that; but then what I am contemplating is a future development.

CHAIRMAN ERNST: You understand that this is not expected to be permanent, that portion of the rule. It is provided until such plans can be submitted and reported on. It will take you some time to present your plans, and those must be submitted and reported on before the final question of what the governments will allow there and what they will not allow can be determined; but in the meantime it seems to be fair to all parties that they should be allowed to go on using what water they are now using. That seemed to us to be fair.

COMMISSIONER CLINTON: I would suggest that perhaps it would clarify matters if Mr. Goff would state what change he would suggest in the rule to avoid this being, as he thinks it might be, an ultimate rule as to time. It seems to me it shows plainly the intention to be temporary.

Mr. GOFF: Does it read to you that it gives power to impose the restrictions on any corporations that have already done all of the things that are spoken of in there?

Mr. CLINTON: That is not the way I understand it.

Mr. GOFF: Of course, if we can hereafter know that it is the intention of this commission, so that that could go along with the rules—in the first place, that it did apply to these corporations as they already existed there, and they must have their plans all approved and everything of that kind by the commission, that would be—

CHAIRMAN ERNST: That is undoubtedly what the rule intends.

COMMISSIONER CLINTON: 'Hereafter no corporations or persons shall be permitted to divert water from the Sault Ste. Marie river'—of course, that diversion does not apply to the Chandler-Dunbar Company. The proviso limiting the quantity of water which they shall use, when taken in connection with the provision in regard to joint approval of the two governments, after the submission of plans—it seems to me that any court would say that covered that corporation, was intended to cover that corporation, as well as others existing, and which may exist.

Mr. GOFF: I feel that there has been on the part of the government a disposition to protect the private rights of persons and of corporations. I have been somewhat astonished to hear to-day remarks made in regard to vested rights in a slighting kind of way, but the assumption upon which I rely with great confidence—and it is a presumption which has been laid down by the highest court in this Union—the presumption is that the government will do nothing unfair, will not take away private rights of individuals or corporations. That presumption extends, under the general rules of law, to the British government, that that shall not intend to impair the rights of a single individual. The humblest citizen in the land in each of those countries is protected in his rights. Now, that is seen by this Act of 1902, where they not only protected our right carefully, but they listened to us when we appeared before the River and Harbour Committee and laid before them our claims in the matter. Now, what I say is that we ask that our rights in this be guarded as clearly as they can be, so that there will not be a precedent furnished for the future in regard to the distribution of this water. If it should go into a treaty between these

two countries and they should relegate to each one of these corporations so much water-power, would it be upon the basis of their rights, or would it be upon what the two governments considered was fair to all of those corporations, on the American side and on the Canadian side? It appears to me that when it comes to the final distribution they certainly ought to consider the rights as they have grown up, of the Canadian corporation and of the two Michigan corporations.

COMMISSIONER CLINTON: Mr. Goff, permit me to ask you a question. Assuming that the decision of Judge Wanty stands—which of course we must assume—The Chandler-Dunbar Company had the right to use the waters flowing past their premises, the natural flow. Now, if the two governments should unite in dividing these waters up, is it possible the government of the United States, in carrying out its duties in regard to that division under any treaty, could interfere with the Chandler-Dunbar rights under any rules or recommendations which may be made, or any treaty which may be made, without condemnation? Can they do it by rules? Can they deprive them of any legal rights which they have by adopting rules?

Mr. GOFF: Possibly not, but the great trouble about that—we had that same matter up when we were before the Committee on Rivers and Harbours, and they said, 'Why do you want to have anything stated in here about your rights being protected? We cannot take away those rights. We cannot take away your property.' 'But', I said, 'unless we are protected by this Act as it stands giving this grant, we can be put to an expense which will amount to nearly the value of our works in maintaining those rights, because we would have to go clear to the Supreme Court of the United States to have them declared.' Now, what we wanted in that Act was to have our rights guarded carefully so that there could not be any claim or basis made for litigation.

CHAIRMAN ERNST: We are trying to guard them here too. Where are they not guarded?

Mr. GOFF: What I call particular attention to is the distribution here of 8,000 cubic feet.

CHAIRMAN ERNST: I have already explained how that came. Now, have you any verbal changes to suggest in that particular paragraph?

Mr. GOFF: I think I can suggest some after a while.

Now, there has been some suggestion made here in regard to this in a general way—and I now desire to have a little branching off—there has been some suggestion made in regard to condemnation of this land of ours, that it can be condemned. Some of the gentlemen who have spoken here in regard to the rights of navigation have spoken about condemning this land of ours. Of course, it is intended naturally that if we should have our land condemned we should be paid for it somewhere near what it was worth. When I was before the River and Harbour Committee, away back in 1900, when this Act of 1902 was brought before that committee, section 5 then provided:

'Nothing herein contained shall be construed to impair the existing riparian rights of any other person or corporation, nor to prevent the exercise in the future by the United States of any riparian rights that it may have.'

When the Act was finally passed that provision in regard to the riparian rights to be exercised by the government of the United States did not appear. It is not in the Act. So that the provision that nothing in the Act should be construed to 'prevent the exercise in the future by the United States of any riparian rights that it may have,' is omitted in the Act, which reads as follows:

'Nothing herein contained shall be held to affect any existing riparian or other rights of any person or corporation, or the existing remedies therefor,

or any action at law or equity now pending. The right is hereby expressly reserved to Congress to alter, amend or repeal the provisions contained in this paragraph.'

Then we have an Act of Congress granting to the Michigan-Lake Superior Power Company permission to divert water off, as an upper proprietor beyond us, up above us, out into the State of Michigan through a canal. Now, if the Government condemns our land and pays us for it, what becomes of their riparian rights? Have the government of the United States by the striking out of that part of that proposed Act deprived themselves of their riparian rights so that when they do acquire them from us they will pass over to the Michigan-Lake Superior Company free of charge, under the provisions of the Act of 1902?

Now, I submit that all of those matters were gone into, and each time that we have had any notice we have contested that this corporation, the Michigan-Lake Superior Power, while it may have a larger capitalization than we, that our rights are just exactly as sacred as theirs. So the history of that Act will show that when that matter was being argued there was no laches on our part. We were right there.

Now, as it comes along down we are shown by the documents here—I do not produce any documents before this commission except such as are official,—but when this matter was presented to the Congress, to grant this, we were not informed that there was going to be any intention of taking away our water. I hold in my hand a House of Representatives Document No. 358, 56th Congress, 1st Session. The map that was submitted to the Board of Engineers shows the proposed dam of the Michigan-Lake Superior Power Company away over on the Canadian side. We did not understand that we were going to have anything taken away from us. The Board of Engineers, composed of Col. Lydecker, Col. Raymond and Maj. Symons—

Mr. MABEE: That is where the dam was built, (indicating on map contained in Document No. 358 referred to).

Mr. GOFF: Yes, it was built there. You can easily see that we did not understand that there was going to be anything to interfere with our rights, that that would divert that Canadian water, keep it from running over there—make that cross-section there—that wouldn't affect us any. And this Board of Engineers said, when they made their report, the matter having been referred to them,—

'Furthermore, the Board begs to state that it has examined the plans submitted by the Michigan-Lake Superior Power Company for the remedial structures required to guard the interests of navigation, and is unable to recommend them for approval for reason that the works are designed to be located on the Canadian side of the river, in whole or in part beyond the boundary line as this is popularly understood to be, where they would be beyond the jurisdiction of the United States, and the Power Company has exhibited no authorization from the Canadian Government for their construction or maintenance.'

Of course, such a statement as that did not escape criticism, and on page 48 of this same document, which is a public document, in a letter that was written by Mr. Clergue, Vice-President, to Col. Lydecker, he says:—

'But the final and almost conclusive recommendation of the Board is that no authority be granted until an international commission determines on what, if any, conditions this water-power shall be utilized. This recommendation is futile since, and would not, of course, have been made if the commission had made themselves aware of the fact that it cannot be made an international question, as the rights in question originally in the province of Ontario are now in the Lake Superior Power Company.'

On page 47, again, he says:—

'Fourth. That jurisdiction and control of the water of St. Marys river rest in the United States and Canada.

'Answer. This is only true as applied to the United States. The simplest inquiry on the part of the Board would have shown them that the province of Ontario possesses the control in Canadian waters, and that in due legal form this province had authorized the Lake Superior Power Company to build dams in the rapids to maintain the level of Lake Superior for the purpose of hydraulic development.'

Now, your honours will see very clearly that there is nothing there to give us any intimation that we at any time are to be affected.

I read now from an official document of February 6, 1900: 'Washington; Government Printing Office, 1900, page 7,—that is when we were discussing this Act down there before the Committee on Rivers and Harbours:

'The CHAIRMAN: Now, in regard to those diverting dams contemplated there, a part of those are on Canadian soil?

'Mr. CLERGUE: Yes.

'The CHAIRMAN: What consent has been obtained from the Canadian Government for the control of that?

'Mr. CLERGUE: The Canadian Lake Superior Power Company has been given the necessary authority by a charter from the Legislature of Ontario, which controls the rights of water and land under the water on the shores of Canada.

'The CHAIRMAN: Does that permission extend far enough to provide for the construction and maintenance of dams for the protection of the canal on the American side?

'Mr. CLERGUE: That is what we claim. If you will allow me, the American development is not considered at all by the Canadians. On the contrary, it would perhaps be unfavourably looked upon by them, but the Canadian company for its own maintenance must have a system of control on the Canadian side, and it will simply enlarge these works for the benefit of the American Company, the American Company participating in the expenses.'

So the commission will see that at no time have we ever had the slightest intimation that we were to be deprived in any way of the rights which appertained to us long before the Michigan-Lake Superior Power came into existence.

Mr. LIVINGSTONE: (Pres. Lake Carriers' Assn.): Do I understand from any thing you have said, Mr. Goff, that you question the constitutionality of the right of Congress to make this enactment?

Mr. GOFF: That enactment of 1902?

Mr. LIVINGSTONE: Yes.

Mr. GOFF: Yes, I certainly do.

CHAIRMAN ERNST: You question the constitutionality?

Mr. GOFF: I question the constitutionality of that Act of 1902. It is a very simple proposition. Under the constitution of the United States, the Congress of the United States is given power to regulate commerce. Commerce includes navigation. Now, what was done in this particular case? Running right in the State of Michigan,—down here, (indicating on map,) in the State of Michigan, Congress has said, 'you may divert the waters of the St. Marys river and run down through a large portion, one-half of the flow, in the State of Michigan, for two or three miles in the State entirely.

CHAIRMAN ERNST: You say Congress has said that?

Mr. Goff: Why, Congress has said they have the power to divert water into any canal.

Chairman Ernst: Not in any such quantities as that. That law gave permission to the Secretary of War to grant permission for them to divert water, but not in any fixed quantity. This 31,000 cubic feet a second didn't enter into anybody's head; but to divert water which did not injure navigation. Just took their hands off, that is all.

Mr. Goff: They were authorized to divert water from St. Marys river into its power canal now being constructed at Sault Ste. Marie for water-power purposes while and so long as such works and diversion of water from said river shall not injuriously affect navigation therein. They are given power, you see, to divert to an unlimited extent, so long as it does not interfere with navigation purposes.

Chairman Ernst: Then you hold also that this limitation that we are proposing, of 8,500 cubic feet per second, is contrary to that law?

Mr. Goff: Oh, no. I am directing my answer to President Livingstone's inquiry.

Commissioner Clinton: The proposition is that that Act is beyond the power of the general government under that clause of the constitution which gives the right to regulate commerce.

Chairman Ernst: I understand that.

Mr. Goff: I have perhaps been a little bit tedious in presenting to the commission some of the matters which have been presented by me, but I am perfectly willing to say, now that I have been asked the question, that I do not see how Congress under a power to regulate commerce, which includes navigation, could take and divert,—for instance, if there were no question of navigation in this matter they could take this international river and turn it into the State of Michigan and let it run through. What has Congress to do about that? Their only power is the power to regulate commerce.

Chairman Ernst: Well, we won't go into that discussion.

Mr. Goff: No, I thought you wouldn't, but you will bear me out in the statement that I did not force this question on the commission; but nevertheless I say, that, with great respect to the President of the Lake Carriers' Association, who never asks any questions without their being of some importance.

Commissioner Mabee: We are not going to hold that; that Act is ultra vires. (Laughter.)

Mr. Goff: I understand,—but that it is *compos mentis* (Renewed laughter.)

Commissioner Mabee: Would you mind my asking you a question, Mr. Goff?

Mr. Goff: No, not if I can answer it.

Commissioner Mabee: Do you admit the right of the Secretary of War to regulate the uses of the waters by your clients that flow past your property?

Mr. Goff: In so far as it can be shown that we are affecting navigation, and as navigation is included in the term 'commerce,' and as commerce is a matter that is expressly authorized, to be regulated by Congress, and as the Secretary of War acts under the Congress, I say, yes.

Commissioner Clinton: If the section of the Act to which you refer is unconstitutional, inasmuch as it is a part of the entire scheme which results in section 4 providing for this commission, has this commission any legal existence?

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Mr. GOFF: I want to continue this commission in its life as long as I can because they appear to be gentlemen that ought to live for a considerable number of years.

CHAIRMAN ERNST: To come back to this question in point, do I understand then that you have any criticism to make of the regulations?

Mr. GOFF: I think that if the commission will bear with me that there yet some remarks to be made upon that, that not being an expert and engineer, I do not want to inflict myself, upon the commission. I would rather have it presented by one of the other gentlemen.

CHAIRMAN ERNST: You leave that to the other gentlemen. Your criticisms are what?

Mr. GOFF: Well, I criticise Rule 1.

CHAIRMAN ERNST: I know, but I thought I satisfied you about that—well, all right.

Mr. GOFF: You understand about that. I can't be satisfied on that.

CHAIRMAN ERNST: Then the next was in Rule 4?

Mr. GOFF: Yes, that proviso of Rule 4, where we were cut down to 4,000 cubic feet per second.

CHAIRMAN ERNST: You think it ought to be 32,000 cubic feet, half the waterflow? Is that your position?

Mr. GOFF: If you are going to have it fixed arbitrarily, I think you ought to give us quite a leeway in view of the fact that we were there first and have been there for quite a few years.

CHAIRMAN ERNST: Well, it is 32,000 then, is it?

Mr. GOFF: Oh, no, not as much as that, but I do not want a *reductio ad absurdum* in there. I want liberality.

CHAIRMAN ERNST: I just want to know where you are, that is all.

Mr. GOFF: And be careful about the *reductio ad absurdum*. If you will hear one of the engineers in regard to those regulations. . . . . .

CHAIRMAN ERNST: Yes, in the same interest, if you please.

Mr. ALEX. DOW: Mr. Williams, as I say, I asked him to be here at the service of the commission if any question should come up that may require his special knowledge, not to present our case.

The remainder of our case is that of the lessee company and is virtually the concrete facts of the case rather than the legal points, and so far as these facts are concrete facts as distinguished from the legal abstractions, of which Mr. Goff has furnished you a sufficient statement, they may be held subject to Mr. Goff's protest to apply to both companies.

Rule 1 is of course objected to by my company, with the request that the commission substitute the words 'shall permit' instead of 'shall grant permits,' making the distinction between the issue of the documents authorizing the use of water and the actual limitation of the use of water. Mr. Goff has made that point, and I think it is fully understood.

As to Rule 4, the concrete fact in the case is that we are at present constructing works which are designed to take care of the absolute, immediate necessities of the Edison Sault Electric Company, including the necessities served by the present works, which we expect to see removed presently, and also the immediate prospective necessities. We therefore make the specific request that we be either, as a maximum request, placed on an equality with the Michigan Lake

Company, or that the figure stated be equal to that portion of the natural flow of the St. Mary's river which would be intercepted by our headworks. We think that would be about 6,000 feet. We point out to you that our headworks are in position, that there is no immediate prospect, in the sense of this year or next year, of our enlarging those headworks, and that our use of water to dispose of the normal flow of the river intercepted by those headworks, would we believe be about 6,000 feet, and that therefore the position of this commission, in saying that pending further inquiry, examination, &c., we shall be limited to 6,000 feet, would be logical, in that it would mean permitting us to use the full natural flow of the river as intercepted by those same headworks. That is a specific request.

Now, in speaking to this it is necessary to put in a little bit of history, and I shall, as Mr. Goff has given a good example, restrict myself to statements which are capable of the most complete proof. The first of these statements is this,—that in 1903 the Edison Sault Electric Company found itself unable, even with the assistance of steam power, to care for its then business arising out of the natural growth of the city of Sault Ste. Marie. In other words, we were taking very bad care of the business connections and we were refusing business offered us by our local public, which is commercially a most undesirable condition, causes great discontent and is a default in public services which no public service company should permit itself to make. In 1903, I, as an engineer, and also as a stockholder in the Edison Sault Electric Company, and also as representing interest not coincident with those, of the Chandler-Dunbar Power Company, was required, demanded, by these interests to take immediate charge, and this condition came to my prompt personal knowledge, a denial of service, and an inability to do even the work that we had been doing. It appeared to me then that this involved litigation and also the somewhat uncertain requirements of navigation, it not being then clearly defined and declared by Congress what it was intended to do to provide additional facilities obviously needed; it appeared to me that it would be exceedingly unwise for my stockholders, they being lessees of the Chandler-Dunbar Company, to increase their expenditures upon the Chandler-Dunbar property, that property being at that time, and in the place where we had authority to make an increase of expenditure, immediately adjacent to the locks, and therefore likely to be promptly required for navigation, and the litigation affecting the various water rights of the Chandler-Dunbar Company, all of that litigation was very obviously before my eyes. It was also exceedingly obvious to me that the Michigan Lake Superior Power Company was not utilizing its actual existing equipment to its full extent. It appeared to me that the interests of all parties, namely, the local public demanding electric lighting, the Michigan-Lake Superior Power Company, very anxious to get revenue, needing the money sorely, the navigation interests and the Government of the United States, preparing plans which might or might not involve the destruction of our existing works,—it appeared to me that all those interests would be best served by a temporary arrangement to last during these unsettled conditions between my company, the lessee of the Chandler-Dunbar Company, and the Michigan-Lake Superior Power Company. On the advice of counsel that in the existing circumstances a court of equity would protect me against any consequences of a technical breach of my lease of Chandler-Dunbar water power, by taking water from some other concern, especially from a concern whose rights were challenged by the Chandler-Dunbar Company, on the advice that I might depend upon the protection of a court of equity, I applied to the Michigan-Lake Superior Power Company for such power over and above my actual water-power development as would permit me to take care of my business and its immediate prospective growth. From the 2nd day of October, 1903, until the 19th day of November, 1904, inclusive, I earnestly and persistently sought from the officers, directors, receivers, counsel and all officers of the

Lake Superior Company, and on the various involved interests at that time being concerned therein, the grant on any reasonable terms, or on any terms whatever almost, of this necessary power, the intent being to preserve this very condition of no additional development on land required for navigation, no superfluous development of power on the American side; in other words, to regard economical conditions. I was denied that power. I have kept careful record of my negotiations and correspondence. I can give the dates of the various interviews I had and the parties they were had with; I can give the notices, when it is pleased, the correspondence, showing that I sought this condition; but it was denied, gentlemen. I did not ask that they should forfeit any rights; I asked that they should protect themselves to the utmost extent by stipulations. I even said that I would obtain, and if they desired to make it a condition I would insist on obtaining, from my present lessors, the Chandler-Dunbar Company, a stipulation and no recognition by us of Lake Superior Company should be claimed by the Chandler-Dunbar Company as affecting the litigation. In other words, I stood out, protecting the interests of myself and my stockholders in endeavouring to maintain a condition which would mean the least expenditure of money on uncertain grounds and the least interference with public improvements. I was denied, gentlemen, absolutely denied; denied by act and denied by word of mouth. These negotiations lasted, as I say, from the second day of October in one year to the 19th day of November in the next inclusive. I was then face to face with a very bad condition, the condition of an inevitable break down of my public service that winter. I met that condition by installing, on top of the best water-power in the Middle States, gentlemen, more steam machinery and burning expensive coal, sitting on top of that fine water-power. That expense came out of the profits of my company. I couldn't take it out of my customers, the public whom I served. The public suffered also in that they did not get a reduction of rates which I should have been warranted in giving had I been able to buy water-power at water-power prices; and, remember, these interests are not the interests of the Chandler-Dunbar Company, save to a minor extent. My stockholders suffered and the public of Sault Ste. Marie suffered through this refusal of a carefully presented, carefully guarded attempt to maintain the status quo and to avoid the doing of these very things which have been reprobated in this meeting.

Following that, gentlemen, it appeared that there was nothing to do but develop according to such rights, grants, revocable licenses, &c., as then might be either in the hands of my company or the Chandler-Dunbar Company. Very sorely against my will, and sorely at my expense,—because, gentlemen, one cannot get money easily to develop on land the ownership of which is challenged even indirectly by the United States government,—after many presentations of the case of counsel and the securing of many opinions, and at a great cost of money, I obtained from my stockholders and their associates the necessary money to make the development which has been specified as this new hold in the rapids and this new embankment &c. Every bit of that work done so far has been paid for by my company, out of money obtained out of our own pockets, where we could ill spare it, and at a high price. In doing so, gentlemen, it appeared to me at once that the interests of my parties would be served by the removal as far as possible from the shore and from the navigation works at Sault Ste. Marie of my new works. It appeared to me that the day when we might have, as I have already said here, three locks, or perhaps, four, additional to the present locks and the approaches thereto—it appeared to me, gentlemen, that that day would come sooner or later, and that the nearer I was to the shore the sooner would the demands of navigation be right on top of me and the paramount interests of navigation displace my works. I then sought from the United States government by its War Department such modifications of permits and licenses as would have enabled me to

go out to the farthest point in the stream where I could economically construct my works, where in fact I could build what works I needed within the limitations of the money I had. I asked those alterations and extensions of permits. The result of it was,—I give it without comment, gentlemen,—that the War Department of the United States by its Acting Secretary of War, transmitted to the Department of Justice a communication stating that in the interests of navigation and as far as the War Department would seem, there was no reason why this removal of my works away from the canal to the limit should not be allowed. The Acting Attorney General receiving that communication stated to me personally that he saw no reason in the status of the litigation then going on, litigation which has since been decided in Judge Wanty's Court, nor any other litigation, why I should not have this removal out into the river that we asked for. He asked if we were willing to file stipulations that no advantage of this removal should be taken in this litigation, nor in any way against the government. We not only said we were willing to do so but did actually file the stipulation by the Chandler-Dunbar Company, received from them by my personal influence. The Acting Attorney General in the circumstances considered that there was no reason why we should do so, dictated a letter to the Secretary of War to that effect, but stated that he must consult their counsel actually in charge of that litigation before that could be done. That counsel is counsel paid by the Michigan Lake Superior Power Company, employed, doubtless within the law and within the limits of good order, by the government of the United States, at a nominal compensation, because of his particular knowledge of the case. That counsel saw cause why we should not be granted this extension, and because of the action of that counsel, the particular paid counsel of the Michigan Lake Superior Power Company, we were unable to take advantage of the expressed opinions and desires of the Acting Secretary of War and the Acting Attorney-General, and the works are placed closer to the shore by about the width of one lock, and possibly a little bit of bank, than we wished to place them. I state this to you, gentlemen, to show that I have built the present works under duress and under great difficulty, that throughout these whole conditions I have earnestly sought to keep out of the way of navigation. In fact I placed in the hands of the Chandler-Dunbar Company a stipulation that my company would make no objection should the government require the removal of its present works, or claim no compensation, on the assumption that we could make that removal and get our service in the new works before the removal was required. I have sacrificed I might say the immediate financial interests, the penny to-day, that we might have got for my stockholders, to the necessities of the public, and consistently all through this matter, that is what I have done. Gentlemen, these works that I am putting up now, I am putting up because I could not help it, not because I wanted to, that are necessary to-day for the immediate care of my business, particularly so when it is understood that I have waived my right to protest in any way or to seek compensation in any way for the removal of my existing works for public purposes that I have settled that matter with the Chandler-Dunbar Company and can make no claim against the United States. I cannot help myself in putting up these works. I need them, I am not putting them up for 'cussedness'; I am putting them up to make a legal point. I am putting them up to preserve a business built up through many years by my stockholders and carefully and economically managed by myself, and in the endeavour to give good service to the people of Sault Ste. Marie and vicinity, under compulsion, gentlemen.

Now, under those conditions, I ask you to consider again the limitation that you have put here; at least, to give me without further question, and pending all your discussions, the amount of water which these existing headworks, being old headworks, will intercept, and in the belief that I shall not require to come to you for a modification of them for quite a long time to come,

in the belief in fact that this confounded condition of affairs which I have tried to keep out of, and which I am pulled into very much against my will, will be by that time cleaned up, that we will all know what we are doing, and that there will be such a settlement of rights and duties both national and international, both local and public, as will enable us all to see what we are doing. My effort to preserve the status which existed before we began these new works failed miserably although it was complete and energetic and patient and painstaking and expensive. The present works represent an effort as far as possible along the same line, namely, to preserve the statu quo to the longest period, to keep out of the way of all conflicting interests, and I ask that that be given full credit, and I ask that it be remembered that it is only sequent on my failure to do better; and I ask that you recognizing those things leave me, because I am only the user of these works at this time, to the 6,000 feet which I naturally would be able to use in the course of the natural progress of this blamed litigation and all these interests that are before you. I speak feelingly, gentlemen, in placing before you matters which could not possibly come before you in any other way, and from the position of one whose whole training is to protect investments, to recognize economical conditions, to be guided by them, never to spend two dollars where one existing dollar will do the work. where all those things have forced him into the position of fighting for his very existence and for the existence of his stockholders' property. That is my position, to-day, gentlemen.

As to the remaining regulations 'a' and thereafter, I respectfully refer you to the brief which I filed with you this morning. Speaking broadly and save possibly some little questions of verbiage, I say that there is no fault to find with those regulations, saving only that I hold that in equity the regulations should prescribe the time in which the actions to be taken in regard to shutting the gates will become effective in the two different classes of power; and I again call your attention to the fact that if it is left an open matter the immediate assumption is that the rule must apply equally and pro rata, and you run at once on the American side into the whole body of water-power law regarding private rights. In other words, by leaving this question as to priority as to whether this shall be shut down first in low water, or that in high water instead of this, if you do not take care of that you are leaving the ground open for a very great wrangle as to prior rights, which will be unseemly and needless. I think the general equity of the principles laid down in the brief which I have placed before you will be admitted by you, and I ask that you go carefully through that.

Taxing your patience a little more, gentlemen,—this morning we had quite a little from different gentlemen which has shown how the public, particularly the vessel-owning public, looks upon this hole in the rapids and these dams and so on which are so prominent when one goes through the canals. The remarks were so uniform and so much along the same lines that it seems that there is either a failure on our part to place before the public the things that we were doing, whereby we have become misconstrued,—a serious failure on our part, or else there is, on the other hand; a widespread and diffuse uniform mis-statement of our intention,—I cannot tell which. In any case I take blame to ourselves in not having sought publicity in explaining to all the world and particularly to all interested in lake navigation, what we were actually doing. I answered briefly one speaker, but to sum up the whole thing, here is where we are. These gentlemen are asking that room be preserved for new locks. We have gone out preparing to surrender, preparing to transfer to the government, our present property in order to make room for new locks, two or three locks without question. These gentlemen speak about land. We have abandoned the land and gone out into the water. Gentlemen ask for a wider channel. We have got out of

the way of a wider channel. We have prepared in every way to make room for a wider channel by keeping away from ground wanted for channels.

One gentleman, at least, Mr. Goulder, made a very pertinent and significant suggestion, that a large forebay which might supply water by laterals to the canals and so avoid the inconvenience and even danger of the inertia of water which now exists through the narrow entrance,—Mr. Goulder suggested that the service would be benefited by a large forebay supplying water laterally to the canals. We are providing that forebay, and if the government desires to utilize that forebay, it is entirely at its service. There is a ready-made forebay which we are now providing and which they may have, and any further forebay we shall be glad to accept a stipulation that the water thereof may be diverted laterally into the canal to aid navigation.

The gentleman whom I really answered, although others repeated the same error, feared that we were cutting away the lip of the basin of Lake Superior, or as our engineers express it, 'lowering the crest.' That we have very carefully refrained from doing, and we have here repudiated any intention of doing it, pointing out that to do so might benefit matters, but we have no occasion to do so and we have not asked to do so. In facts all our works are some 1,000 feet down from the crest and more than half way, or at least half way down the hydraulic slope.

Finally, it has been put very clearly before you, and I know is in the mind of all the lake carriers,and particularly of their President, that it is hard to get appropriations from Congress for betterments to navigation and that when the money is appropriated it should be spent really for betterments and not for buying out expensive hydraulic developments. Gentlemen, I knew that all the time, and I have gone as far as I could away from you so you wouldn't have to buy me out, and I have quit-claimed to my landlord my present developments in order that his hands may be absolutely free to deal with the government without any question of expense for those developments. I admit the failure to make this public and send it out to every vessel owner in the country; I admit the failure to give it to the newspapers—I have never been much on giving things to the newspapers; it has usually been their gift to give things to me,—we have omitted to publish all that, and have failed perhaps to secure publicity and have thereby allowed the justified existence of a wrong impression, or given opportunity for the propagation of mis-statements; but every one of these things that these gentlemen want and have asked for to-day are the things that we at great pains and at great expense and over a term of years, the Edison Sault Electric Company, have recognized and to the utmost of our ability provided.

Now, gentlemen, I come before you with absolutely clean hands, as one who has no desire to be in these controversies at all, as one who has to the utmost of his ability kept out of the way of public improvements and facilitated the same, and I ask that you recognize that and leave me when I will be in peace; let me use the water which I am asking to use in that period and let the others scrap it out. And, gentlemen, take your time also. You will give me ample time without troubling me in my work. If you give me what I ask for, namely, the natural interception by my present head works of the natural flow of the St. Mary's river, you will also be logical in doing so, as you will thereby tend to maintain the normal or the natural regime of the river—all of which is submitted, gentlemen.

Mr. GOULDER: Just what are you using now?

Mr. DOW: We are using, when we can get it—

Mr. GOULDER: I mean now what are you using? What are you using this year?

Mr. Dow: We are using, water-power, about 700 h. p., and steam power, about the same. For the steam power we are burning very expensive coal and smudging up the neighbourhood.

Mr. Goulder: Well, our steamboats smudge up a good deal more than you.

Mr. Dow: Well, your steamboats get up the river before any one swears about it, and we stay there.

Mr. Goulder: How does your 6,000 that you ask for,—that is what I want to get at—I don't understand these things,—but how does the 6,000 that you ask for compare with what you now have in use in fact?

Mr. Dow: It is a considerable increase of my now use, but my now use will be closed up and wiped out by the next step in the proceeding.

Mr. Goulder: What are you now using?

Mr. Dow: Speaking off hand, I should have to ask Mr. Williams. I don't know what we are using now. I am asking, as I say, the amount of water which would naturally flow over the rapids of Lake Superior through my intercepting works; no more nor less.

Mr. Goulder: Pardon me. This is very technical to me. You speak of preserving temporarily the statu quo, and your status is that you be permitted to flow 6,000 feet.

Mr. Dow: Yes.

Mr. Goulder: What I desire to know for my own satisfaction is how that compares with the present use—heretofore.

Mr. Dow: Oh, it is a considerable increase over my present use, and will provide for the substitution of water power for steam power which I now use, and will provide for business in sight and a reasonable growth of the business long enough to clear the air, as I say—to get done with the litigation in question.

Mr. Goulder: Then, if you are furnishing 700 h. p. by steam and the same by water, you eliminate the steam and double the quantity of water. Then how much increase?

Mr. Dow: I provide for a considerable increase, enough to keep pace with the natural growth of my business for several years.

Mr. Goulder: Well, now would you double that?

Mr. Dow: Oh, yes. If the business doesn't double in the years that this litigation may drag, I shall be a disappointed man; and you will remember, if you please, Mr. Goulder, that I also serve the public—

Chairman Ernst: Perhaps Mr. Williams can answer your question in a minute. What is the use of water up there?

Mr. Williams: Well, the ultimate development—

Chairman Ernst: No, now; the present use of water there.

Mr. Williams: About 700 cubic feet a second.

Mr. Dow: It is very much smaller, and even if I displace my steam power and possibly double the business, I would not go to 6,000 feet. I admit that frankly. I say I have put in my head works; the intercepting area which I expect to discharge will be equal to that, and I ask that the commission, taking all the facts in view, including those I have just presented before it, establish a ruling that will leave me out of any question or agitation or application for permits or discussion of any sort whatsoever, for a sufficiently long time to let things be restored to the condition in which the commission desires to place

them; and I am asking this calling your attention at the same time to the fact that the sum of that amount and the allowance for the Lake Superior Company will still be very much below one-half the natural flow.

Mr. GOULDER: About how many years would it be in your best judgment before that 6,000 flow would be required?

Mr. DOW: Be required by my company?

Mr. GOULDER: Yes, by you.

Mr. DOW: I should say, repeating what I have said already, till this litigation is out of the way. That is to say, judging from the average case of the litigation, it looks to me like three or four years of trouble.

Mr. GOULDER: You can't guess on litigation. We know more about that than you do. We know it is impossible to guess.

Mr. DOW: It looks to me like three or four years of trouble, and it looks to me like I won't have to worry whether the next customer I connect will run me out of the water.

Mr. GOULDER: As near as I can gather, then, your answer to my question is this, that the proposition is to increase by permit the present flow of water 8½ times, that is, until it shall be 8½ times the present flow, and say that that shall meet the requirements for four years beyond now.

Mr. DOW: Possibly, but I take exception to your way of phrasing it. I say that this permits us to maintain the normal flow of Lake Superior now interrupted to some extent by those head works. The head works are in excess of the present use and were built with a view to prospective use, including what I am now developing, and these head works so far have tended to raise the level of Lake Superior. In other words, I am asking to be allowed to go up to the use of my present expenditures, that is all.

Mr. GOULDER: I notice on the map there, which I never saw until to-day, that you have run pretty well across by the map. What is that? (Indicating.)

Mr. DOW: That is a line showing what would have happened if we kept on above.

Mr. GOULDER: How far would you have to go to get 6,000?

Mr. DOW: 6,000 feet is about here.

Mr. GOULDER: Those two piers?

Mr. DOW: Those two piers, yes, unless the government fills up and cuts me off.

Mr. GOULDER: Without any excavation?

Mr. DOW: Without any excavation only the cleaning out of this part. You see, you will cut out my present canal in the first fill. We assume that that will come out in the next movement of the locks and that we will therefore positively have to dredge that straight.

Mr. GOULDER: Well, you will have to deepen?

Mr. DOW: No, sir, we won't have to deepen above there. Let me take that clear to the rest. We have in no case touched the controlling factor in the discharge, namely, the crest of the rapids; in no case whatever, nor do we ask leave to do so.

Mr. GOULDER: Now do you multiply your flow to 8½ through there without affecting it?

Mr. Dow: We have now headworks which intercept two piers of the International bridge. Since the construction of those head works, and particularly since they have been made tight, the river is compelled so far as it does not flow through our present wheels to go through the remaining spans of the bridge. Therefore there has been a tendency to establish a higher stage of the river in Lake Superior. In other words, what we have done within the past few years in the putting up of these head works has tended to raise the level. We put those head works up with a view not to the immediate pinched use but to what we might use reasonably within a year or two, which in fact we would have been using but for this unfortunate condition of litigation which has discouraged our capitalists from making investment there. We ask that that now be permitted so far as it lies withing the power of this commission, and submitting respectfully that there is in that concession no endangerment to navigation; and if it be the opinion of this commission to the contrary we would very much like to be allowed to reconsider our request; submitting absolutely that we cannot by so doing endanger navigation, we ask to be allowed to continue to discharge sooner or later, within a period of years, the flow which formerly went through those two spans and is now intercepted by our works. That is the condition.

Mr. Livingstone: Is that the Islands 1 and 2 just to the left?

Mr. Dow: Those are Islands 1 and 2. Those are islands in litigation and which Judge Wanty has held applied to the outlets.

Chairman Ernst: Prof. Williams, what is the capacity of these works now under construction?

Prof. Williams: About 4,000 cubic feet.

Mr. Dow: I may say this much—it will probably follow up the Chairman's question. It would seem to me exceedingly likely that we might add another section, penstock, to these works, which would mean that we would need somewhere near the 6,000 feet, or at least that 6,000 feet would be approximated. It seems that we might do so.

Chairman Ernst: That is in the future some time?

Mr. Dow: In the future, within the term of this litigation which I tried to guess at.

Chairman Ernst: But you have actually under construction, with capital provided for building works, about 4,000?

Mr. Dow: About 4,000 feet. I might say, gentlemen,—you answered Mr. Goff how that were got at, but I assumed as soon as I saw that figure that you had simply allowed me to use the works at present under construction. I want to say that the head works intercept more than that flow of the river.

Chairman Ernst: I understand that.

Mr. Dow: And that I can see that we may want very soon to add another section to the existing plant, three sections.

Chairman Ernst: Suppose that you were on the other side and wanted to enforce the rule that the companies must present plans for approval, wouldn't you be likely to hold them down to something like what they were immediately using?

Mr. Dow: Oh, surely, I may say this much,—we are not asking exceptions to that ruling as that goes out. I know that you must have plans for approval In fact, we have, I believe, furnished you with plans to a considerable extent We have had our own reasons, I may say, gentlemen, to some little extent with holding these plans, and the reasons do not in any way reflect upon this commission. As it stands, that reason is possibly even now set aside.

CHAIRMAN ERNST: Here is a rule which is to be recommended perhaps to the government for adoption, that plans must be submitted for approval. Now, if we allow you 6,000 feet, you don't submit plans.

Mr. Dow: We will submit plans if you wish, but I don't want that written in there '4,000 feet.' Gentlemen, I don't want to run up against the statement all through the country that this engineering board has looked all this matter over, and you cannot make that explanation in any other way than that; you will have to admit that this Board has looked over all that matter and has awarded us 4,000 feet, and twice that to the Lake Superior Company.

CHAIRMAN ERNST: Couldn't an inference of that sort be met by the interpolation of a few words there?

Mr. Dow: Possibly.

CHAIRMAN ERNST: 'Being the quantity now already in use' or 'for which works are constructed' or something of that kind?

Mr. Dow: That would again bring up the question of head works.

CHAIRMAN ERNST: Explain how the figures are reached. We are not attempting to decide between these litigants.

Mr. Dow: I understand you clearly: I am trying, as I say, first of all, to keep out of the way of everbody. There is, as I say, no reason in any way reflecting on this commission why the most complete plans should not be placed in your hands. There are reasons which seemed to our officers, as I say, these may even now be removed, and we have no idea of withholding our plans from you or in any way concealing them. I think our general conduct is along these lines. At the same time I say that the adoption of a rule of 4,000 feet will work a hardship on me which I respectfully submit is not warranted by the actual conditions. I submit that, showing, as I have, regard and consideration for public necessities, and particularly for the necessities of navigation, we should be dealt with possibly liberally. I am not asking you to limit any one else; I am simply asking that you allow me to utilize what water would have gone over the falls between my intercepting works had I been able in the last five or six years to go ahead instead of being hindered, as I sorely have been. That is what I ask. I submit that, gentlemen, and I want to say that I have no question, no likelihood of in any way questioning the intent or capacity in any way of this commission. I want to make that very clear to you.

COMMISSIONER WISNER: In regard to that 6,000 feet,—in the natural condition of the rapids, if it is possible for 6,000 feet to go through those spans, I want to ask Prof. Dow if that amount would go and still maintain a head on his wheels.

Mr. Dow: We think it would under the conditions that we assume, that this reef business be straightened and bends be taken out. We think it will go. If it does not there will be a reduction of the discharge, that is sure. The thing is self-correcting. I say frankly to you, gentlemen, I do not know that I need 6,000 feet this year, or next year, or the other, but I do not want an erroneous impression going out, that will inevitably go out—I have heard it and you have seen it, a very strong, false impression, this morning, very widely developed—

CHAIRMAN ERNST: I think we understand your position.

Mr. Dow: And I would like to be put by this commission on such a footing that I need not make any explanations.

Mr. JOHN C. SHAW, of Detroit: Mr. Chairman and Gentlemen.—It is with some hesitancy that I follow my good neighbour Mr. Dow, especially as he appears to be such a benefactor, but the fact is, we want what we can get and so does Mr. Dow.

To go back a little in this matter, as he has done,—well, prior to the engineering report which he has referred to,—an early report, I think it was 1896,—Mr. Clergue and his associates purchased and started a canal on the Canadian side. They also at that time projected two canals, another one which has been abandoned. Mr. Chandler, the president of the Chandler-Dunbar Company, personally persuaded Mr. Clergue and Mr. Douglas to come over with a view of buying this water-power canal of the Michigan-Lake Superior Power Company that we now have there. Mr. Chandler was interested. Without going into details he did, with others there, induce our people to go in and make an investment and buy out the work of the power company which had been projected, where our Michigan Power Company is now. Mr. Chandler was on our pay-roll, was our agent there in the purchase of these lands. We went on with our work and got our millions invested there. When I say 'our millions', the bonds were out. Those bonds are scattered over this country among investors, men and women; their savings are in there to the extent of $5,900,000 in bonds. I appear for those people here. After this investment was largely made the engineer commission was appointed to investigate. Mr. Chandler went before that commission, and for the first time we learned that he had claims antagonistic to ours. Our money had already been invested. He protested there. He filed a brief. That commission did report, and the engineers on it reported on legal rights and declined to grant us what we wished to do in the diversion of water, reported unfavourably. It is unnecessary to say that Mr. Chandler ceased to be on our pay-roll from that time on.

Later the Lake Carriers' Association took this subject up, and we were invited down before the River and Harbour Committee, to show what we proposed to do there. For three consecutive sessions we were there. Mr. Burton, the chairman of the River and Harbour Committee, had with him for advice Genl. Mackenzie, and they proposed an Act which should protect the public navigation interests. Now, by that Act we did not get our charter. We claim that we had a right to put water down through Michigan there under the laws of Michigan, under our charter from the State. The public thought, Congress had the right, as they claimed, to say that our diversion should be upon such conditions as they should prescribe for the protection of water levels and the public interests. We went down there, and Mr. Burton, anxious as he was that there should be a bill introduced, was unwilling to take any chances of his River and Harbour Bill. The only way he could get this through was to have it come up by unanimous consent. It became then a case of contract with us. That bill was prepared. Conference after conference was had before the River and Harbour Committee, with the Lake Carriers present, and we agreed, with the conditions as they were supposed to be then, to undertake the large matters that we did in that bill for the protection of the public, recognizing that their rights were paramount.

At that time we had projected another canal. When I say 'we,'—the same parties at that time had promoted it. To-day it is an entirely different situation. The Michigan-Lake Superior Power Company, that I represent, is in the hands of a receiver for the benefit of these bondholders scattered over the country. But the parties that were promoting that at that time also had in view a canal in the rapids, down through these rapids; had another plan to go over in Canada here. They say, 'You seem to have control of the whole situation and we can only reach it through the Michigan Company.' We called attention to this Chandler-Dunbar Company with its claims down here.

Mr. Burton had Genl. Mackenzie send over and see whether or not, as they claimed then, they were planning some enlargement. They didn't find that they were planning anything. At that time they said it was a small concern, 700 cubic feet a second. Mr. Goulder, speaking for the Lake Carriers' Association, said 'You needn't bother about that. When that conpamy undertakes to make any changes here, the public interests, before they will be permitted to go on, will see that they are brought forward and treated just as strenuously as you have been to protect public interests.' That was O.K'd by the others present and I think practically assented to by Mr. Burton, who was present. We got our rights to go on through there with our arrangements. We have gone ahead. Now we find that the Chandler-Dunbar Company has not asked for any permits, but we do find that a lessee comes and asks the government for permits. We find what is to me an astonishing condition of affairs,—that permits have been granted to A to do certain things upon the lands of B, the lands claimed by B. A lessee comes in and asks for permits, not claiming to own a foot of ground there or anything else in that rapids, but simply says 'I am a lessee, and I want,'—as he says to you gentlemen now,—'I want you to help me make my fortune.' Now, I would like to see Mr. Dow make his fortune, but the government in granting those licenses granted them on condition that there should be a refunding in money to the government that was necessary in the future for changes made and all that; but those changes are not made on their lands. They are made on the Chandler-Dunbar lands. Suppose you go on under this revocable license, and you go to the Edison Soo Company to carry out its undertakings even then, and the Chandler-Dunbar Company says, 'No, we never made any agreement. That is a part of my realty now; it goes to the holder of the realty.'

Now, when the Act of Congress came up, we had before them the plans of our comtemplated completed canal. When they granted us those rights, there, the Chandler-Dunbar people, as Mr. Goff stated here, did say that the riparian rights of the government should be protected. We protested that that was not fair. The understanding was that if we were to put the remedial works out there and save the expense to the government, and we turn those works over to the government, that the government should not reserve its public rights out there as against us in that matter in protecting water levels. So they did grant us so far as they could the right to use water there, and the condition upon the use of the water under those plans as they were afterwards approved by the Secretary of War, were simply that we should put the remedial works in to protect water levels. Now, they did not undertake to pass on the claimed riparian rights, or on the title to lands or those islands. While there is a decision now, that is a matter still to be decided. It will have to be decided in court, and it is not here or there. They did not though get any rights. That Act did not grant them any rights. They were there in the conditions—there was no objection to the conditions then existing. Now, we accepted those regulations. We are still willing to accept regulations reasonably binding our company, and *any* regulations that are necessary to protect the paramount interests.

I am not going to go through these fully in detail. I do not see anything objectionable in the first two or three rules proposed, that others saw in them. You take the levels provided there, I believe they are based on the present condition of affairs, and I think those limits are less than the natural fluctuation would give.

COMMISSIONER CLINTON: 601·5, 603?

Mr. SHAW: Yes, 601·5, 603. When I speak of these engineering things, of course I don't know anything about it except that I get these from the engineers whom we employ.

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CHAIRMAN ERNST: 603 is very nearly the maximum. It has been above there once in the early history of the lake. 601½ is very nearly the minimum. It has been below sometimes, but not usual.

Mr. SHAW: As I say, if that is considered proper, we are not making any strenuous objection to that. But to this we do object,—with this company using 700 cubic feet per second going by there, we accepted that Act of Congress under conditions, and under those conditions these water levels that you require us to keep, or the others to keep up, were based upon that then existing condition; and we do protest at this time against the change being made here which Mr. Dow just suggested. I am told by our engineers that when this flow, holding the water back as they do here, when that is cut away and this flow is increased from 700 to 4,000, that thereby they will eventually lower the natural level of Lake Superior 2-10 of a foot. If it is increased to 6,000, it is 32-100, nearly a third of a foot. We then, to help out our Brother Dow are called upon to undertake to care for those changes which he makes in the present condition there. Now it seems to me that this commission, if they are going to maintain the statu quo with regard to us, with regard to the Canadian Company, certainly should not permit any changes to be made by this company at this time.

COMMISSIONER CLINTON: Mr. Shaw, you say you object to the change suggested by Mr. Dow. I take it you mean the change in the 4th regulation fixing temporarily the amount to be used by the different companies?

Mr. SHAW: Yes; we are limited there. And I might say right here that we have contracted and have got to suffer damages for the Michigan Company for 20,000 cubic feet. Now we are only furnishing, have been furnishing, 8,500. We are prepared to furnish 10,000. We have put in compensating works practically for the 10,000. Now he on a contemplated improvement suggests that he be allowed to go on and take this large power, change present conditions. We, with our money in there, and with everything done with the investment fully made, with a large investment out there in the rapids, under the Act of Congress, and to protect water levels, an investment, there providing for compensating about 10,000 cubic feet, are even limited below that 10,000.

Mr. CLINTON: Well, what I am getting at is, you object to the quantity allowed the Chandler-Dunbar Company, or the Edison Company, whichever you mind to call it, being changed so, as to allow them to take in, to use, 6,000 feet?

Mr. SHAW: Or anything over their present use.

COMMISSIONER MABEE: He says it ought to remain at 700.

COMMISSIONER CLINTON: That is what I am getting at,—it ought to remain at 700 feet. Of course, under the circumstances, this is temporary.

Mr. SHAW: And I do say that under all the circumstances that we are placed in there, as a matter of equity, not personal charity to me or some one person, but as a matter of right, with the investment made for that purpose, we should not be limited below what we have compensated for already, under authority and approved by the government. That would be the substantial and correct preservation of the statu quo, in my mind. Of couse, we recognize that further remedial works must be put in before we go beyond that.

Mr. GOULDER: Mr. Shaw, will you pardon a question at that point?

Mr. SHAW: Yes.

Mr. GOULDER: Not to interrupt or disconcert, but to bring out the fact,—has there been, since the water was turned on, or has there not been, any complaint by reason of the diversion as affecting the level up there?

Mr. Shaw: I do not know of ever having any complaint.

Mr. Goulder: I never have heard of any. I didn't know whether you had heard of any.

Mr. Shaw: No, we never have had any complaint. We have compensated for more than we have used, and we say that the statu quo to be fairly considered should be that which we actually compensate for—we should be allowed that.

Commissioner Coste: That is the Michigan side only?

Mr. Shaw: Yes.

Commissioner Coste: Not controlling the water taken by the Canadian Company.

Mr. Shaw: Well, there was a natural flow through there on the Canadian side of about 8,000, which they have blocked up, and have only been using so far about 7,000. In addition to our compensating works, in connection with that canal they have compensated for more than they have used, in making the works in the natural channel over there, there was a natural channel. So that we have got our investment completed. We are in a position where we cannot possibly pay interest on those bonds from what we are using. We have got our money in for compensating works. We should be allowed I think to use up to those compensating works, and no new company should come in and offer or to be allowed to make a change of a part of an inch, to say nothing of what this plan contemplates under the work that they have started on now.

Chairman Ernst: Your position is that you should be allowed 10,000 cubic feet?

Mr. Shaw: For the present, yes.

Chairman Ernst: Under this proviso?

Mr. Shaw: Yes. Understand, I haven't gone into the working. I understand the purpose of the commission is to have us come in before we go on with that—

Chairman Ernst: This is only until your plans are approved.

Commissioner Coste: In the 10,000 feet you mean the amount that your remedial works provide for?

Mr. Shaw: Yes, and that is temporary; but I understand that you will then thereafter take up plans before any changes are made. Of course up to that point our plans have all been approved. We are not going on with any unapproved plans.

Chairman Ernst: They haven't been approved by this commission.

Mr. Shaw: Not yet.

Commissioner Clinton: If this commission is to be continued, or another commission appointed, it is absolutely essential that it should have a record of some kind upon which it can base its action in enforcing rules and regulations existing and in making rules and regulations in future; and it is with that in view that we ask you for and have sought plans for existing works as well as those which may be contemplated in the future. I only make that suggestion so that there may be no misunderstanding.

Mr. Shaw: Of course, our works there now, are subject to the use of the public for the protection of all the public interests.

Mr. Goulder: The only point, Mr. Shaw, is that they should receive the approval that was required by the only existing law.

Mr. SHAW: Yes. We have been approved up to that point, and really we have been approved beyond that. The Secretary of War has approved further plans which would provide for about 15,000 more, but we take it this commission will be easy to reach and there will be no delay.

Commissioner CLINTON: Let me suggest that this commission is not in the position that the War Department is. This is an International Commission. For that reason it should have its own records.

Mr. SHAW: I recognize that, Mr. Clinton, and I do not ask to have this commission adopt the approval that we already have of the War Department, to go on and complete remedial works, but that the works we have already completed under their authority should be recognized as authorizing us for what we have actually compensated.

Mr. LIVINGSTONE: May I ask, Mr. Shaw a question? It has been suggested by what you have just said. Do I understand that your proposition substantially is this, that you have constructed remedial works for a flow of 10,000—

Mr. SHAW: Yes.

Mr. LIVINGSTONE: Under the plans approved you have been allowed 8,500?

Mr. SHAW: No, there is no limitation on what we should take. We only take 8,500. Our limitation comes about because of certain work in the power house that had to be done. The people were waiting to use the power but we couldn't give it to them because of some trouble of that kind.

Mr. LIVINGSTONE: To what extent have they been approved, 10,000?

Mr. SHAW: The plans have been approved so far as completed, to 10,000, but they have been approved further to the extent of 25,000.

CHAIRMAN ERNST: Let me correct that. They haven't been approved for any fixed quantity of water.

Mr. SHAW: No, but I mean to what we compensate.

CHAIRMAN ERNST: They have been approved simply to the maintenance of levels.

Mr. SHAW: Yes.

CHAIRMAN ERNST: The whole thing hinges on levels, and you cannot take an ounce of water there unless those levels are maintained.

Mr. SHAW: We recognize that, Mr. Chairman, and do not question it at all; never have questioned it.

Mr. LIVINGSTONE: The question I was going to ask you was this,—in case this commission after careful review of the matter came to the conclusion that you were taking more water than you ought to take consistent with levels, whether, having been approved, or fixed at a certain point, or you were taking that amount figuring that you had that approval, whether you questioned their right to review that and lower the amount provided in their judgment you were taking more than was consistent with levels and lake navigation.

Mr. SHAW: Mr. Livingstone, so far as our rights are concerned, we recognize that the public is entitled to use them to the shutting up of the canal or anything that is necessary to protect those levels. Now, if our rights are affected through the giving of rights to some one else that is not the public, why, then another question would arise; but so far as the protection of public interests is concerned, our whole works are there.

Mr. GOULDER: You are simply assuming then, Mr. Shaw, that the commission, that prominent engineers of the government having approved certain

works, that this commission or any other authority would approve them in the same manner?

Mr. SHAW: Yes, would approve up to that point, and I am not asking them to go beyond that at this time.

I do not like the suggestion made this morning by Mr. Dow, which practically amounts to this, that he would take the rapids and take the flow over there, and use our Michigan-Lake Superior Power Company as a remedial works simply to take care of the overflow that he might hold back. But so far as shutting it off, or using it, not for him, but for the public, I think we are bound, and we have agreed to it, and we do not question it and will not question it. I think with that before you in good faith, with everything before you that has occurred, that this commission, sitting as you do in the place of that River and Harbour Committee, when we went before them and made our contract with them are in honour bound to regard our investment there and protect it so far as you can rightfully do so. I do not believe that any new company coming in, before its investment is made, should be permitted to go on and extend that investment except upon conditions that we might have the use of those rapids for remedial works to take care of vested rights as well as of the water levels. I think that with our contract with the government and with these investments there, we are entitled to have precedence. I think that that investment should be recognized to the fullest extent before they are permitted to extend at all. I think if it comes to a question of shutting off or interfering with works, instead of shutting off those that are established, on their 700 cubic feet, instead of shutting us off on our development for which we have expended the money in full, that there should be a shutting off of the addition made, and from this time on. Now, I am not here to talk on what the public needs out there, but we have all to recognize that public right; and I do think that our company, our investors, are entitled to some equity and some protection here. I think that Mr. Dow is entitled to protection so far as his canal has gone, but I do not think that you are called upon unless you feel that you are absolutely forced to do it, to take from our investors and give to him an investment of their money. Now, if he has rights out there whether you need them to protect water levels for the public or to protect vested rights of the people who are allowed to go in there, when he sat by and saw us complete those works he is estopped in equity, I think, when he sat by there and never objected to our going on, knowing we were going to take it, when Chandler, the president of this company was there acting as our agent and investing these people's money from all over, and then have them come here and say 'Take care of me and let these poor investors go.' I think that so far as you can do so you are in honour bound to carry out our agreement with Congress and you are bound to take enough control of those rapids to protect water levels with the least punishment to us. Now, we are willing to accept all regulations, to let you shut our canal up, but we say, don't do it unless you have that right and because we agree to it, that is no reason why you should do it. It is one of those things that should be done in the very last extremity; and this great government, to carry out its good faith might better afford to buy, if it turns out, which I very seriously doubt, that the Chandler-Dunbar Company took this little strip of land which the government had not taken in for its canal use, got all those property rights out there,—then let the government pay them fairly for it, protect Mr. Dow, protect Mr. Chandler in what they have got in there, but do not *give* to him, do not increase that, until other rights existing that were allowed to go in there without protest and with their connivance and tacit consent at least, until they are taken care of.

Gentlemen, I have not gone into the details of these rules. You are here to take care of this matter. You have competent engineers, you have competent lawyers, and you are better prepared than I am and know what is necessary.

I only say that we are willing, so far as the public interests are concerned, to do anything and everything and to be a party to any kind of a binding agreement. Next to the public, take care of the vested rights, and then if there is anything left I am perfectly willing you should give it to Mr. Dow or anybody else, but I think that that is the manner in which the matters should be taken care of and should be considered by the commission.

CHAIRMAN ERNST: I understand then that you criticise Rule 4 so far as the distribution of quantities for this temporary use is concerned, and no other rule or regulations. Is that right?

Mr. SHAW: Except that there should be a provision that any new company going in there, if they claim rights, that they should surrender enough to the government to protect already existing conditions, at least, investments and the public—for remedial works. We did not agree to the 4,000.

CHAIRMAN ERNST: But that is the principal point, as I take it, to which you take exception?

Mr. SHAW: Yes, at this time, and with the understanding that they do nothing, that the plans must be submitted and approved.

CHAIRMAN ERNST: Certainly.

Mr. ROWELL, K. C., of Toronto : Mr. Chairman and gentlemen of the Commission,—speaking on behalf of the Lake Superior Power Company, the rules and regulations involve a complete change in the relation of this power company to lake navigation. Up to the present time the Lake Superior Power Company has not been subject to any general rules or regulations as affecting navigation which, as we understand the position, entitled our own government or any other to interfere with the use of the power or the use of the water which flows into the power canal on the Canadian side. These resolutions contemplate bringing the Lake Superior Power Company under this joint control and making our works subject to the paramount rights of navigation, as those rights may be exercised by this commission by joint international authority.

I want to say very frankly that we do not object to that position. We recognize the paramount rights of navigation; and, important as are the power rights of the Lake Superior Power Company on the Canadian side of the river, almost as important to them is the preservation of navigation; for the Lake Superior Power Company, or the other companies associated with it, own or, charter some twenty vessels carrying passengers or freight on the Great Lakes and are in themselves the largest transportation concern doing business on the Canadian side of the river, and it is vital to their interests and the future development of those great works at Sault Ste. Marie that there should be the most adequate facilities for navigation and the obtaining of the cheapest possible rates of freight for incoming and outgoing vessels. So much, then, on the general proposition.

The only thing I might add there, and perhaps it is something this commission has considered already,—there is just the question whether on the Canadian side of the river the same reservation should not be made in the interests of navigation as has been suggested by the shipping interests should be made on the American side,—the question whether there should be any works erected south of the present Canadian power canal, the same as the shippers on the American side have suggested there should not be any works erected on the north of the present American canal, the question whether in the interests of navigation that river bed should not be preserved by the two governments intact for the general use of the public.

I come then to another proposition, and that is one suggested in the memorandum filed by the Edison Sault Electric Compa as to the relative respon-

sibility of the different power companies for lowering the level in case there is any lowering of the level of the lake. The position of the Lake Superior Power Company is this. There was a natural channel where the canal of the power company now is, and substantially I take it, there flowed through that channel the amount of water which the present canal will take. There may have been, may be, some slight variation, but not a very great variation, as I understand the condition. We would then be exempt from the condition Mr. Dow suggested this morning. We would come in the catalogue of those who do not divert but intercept water of the river, and therefore would not be liable to being shut down under the regulations as suggested here in case of lowering levels. However, our company may not always be in that position; but whether it be in that position or not, I take the basis of the whole regulations of the lake levels to be this,—no company will be permitted to divert unless it makes adequate compensation; that the compensation must be equal to the diversion. That having been done, all companies then stand on a level, and if there is to be lowering of the water, it is due from natural causes, and all companies should share equally in the responsibility for the protection of the interests of navigation. In other words, the company, that diverts, if it compensates equally it stands in exactly the same position as the company that intercepts; and therefore, the basis having been fixed that compensation must be equal to diversion, the general regulation should apply to all companies alike, and the people who put up their money by way of compensation should be in no worse position than a company that intercepts.

Then, passing on to one or two of the resolutions,—Resolution 3,—and I mention it because we for the first time come under this regulation,—Resolution 3 provides the maximum and the minimum levels of the lake. Now, under existing conditions, the Chandler-Dunbar Company using 700 cubic feet per second, we run no risk. Our works are put in no peril by agreeing to this resolution; but if the Chandler-Dunbar Company were permitted to take through spans 1 and 2, instead of 700 cubic feet per second, 4,000 or 6,000 cubic feet per second, you would put our works in peril, because the inevitable result is a certain lowering of the lake just by the extra amount which you permit diverted through sections land 2. Now, as representing the Lake Superior Power Company, which has not hitherto been under any regulation, we decidedly object to being put in that position. We come here willing to abide by the rules you may make for the protection of the interests of navigation, but we cannot consent unless we are compelled to consent to be put in a position where our works may be put in jeopardy by this commission giving the right to another company to take water out which will lower the level of the lake. What I wish to say, gentlemen, with all respect and deference, is this, that if you purpose doing that, then in fairness to us you must modify levels 603·0 and 601·5 for our protection. We do not ask that they should be modified. We are prepared to let them stand in the interests of navigation, but do not put us in the other position.

Then, coming down to Rule 4, on behalf of the Lake Superior Power Company, we cannot agree. You will already see I object to the provision in Rule 4 giving the Edison Sault Company more than 700 cubic feet. But speaking particularly for the Lake Superior Power Company, we object to the limitation to 7,000 cubic feet per second. I presume this means an average, I just ask it for the sake of clearness. This means the use of an average of 7,000 cubic feet per second, does it, Mr. Chairman? I explain my reason, Mr. Chairman, for this. The present use is about 7,000 cubic feet per second for six days in the week. The works are practically all shut down on Sunday. If it is an average there is a certain amount of leeway there over the actual existing uses. If it is not an average it is tying us down to the actual power now being used in the canal.

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CHAIRMAN ERNST: This is one day in the week. All that would average up.

Mr. ROWELL: Would average up?

CHAIRMAN ERNST: Yes.

Mr. ROWELL: Then let me say, however, that in any case we must object to that limitation. Our present canal capacity is approximately, 9,000 cubic feet per second. We are willing to come under your regulations, which we are not under to-day, but we say that in fairness you should not cut us down beyond what our canal is capable of utilizing in connection with our works; and I point out the position in which you would put us. At the present time the company is under contract, has given an option in connection with a company that is taking over the operation of its nickel mines and nickel works, on, 1,000 horse power. Now, if the parties take up that option it simply means that you put our company in the position of having to stand a very serious damage action, and you render it impossible to open up large and extensive works there which are ready to be opened up and where there are the facilities to supply the power.

Let me tell you, further, at the present time the allied company, the Pulp Company, is not operating its sulphide mill. The early operation of that is contemplated. When the reduction works, the nickel works, and the sulphide mill are in full operation, and the additional work in connection with the steel plant which has been decided upon, it will require every ounce of power which the Canadian canal can develop to carry on those works, and to put us under that limitation would be simply tying and hampering the industries there in a way which I am sure you do not desire to do. And so I submit that this reference to the Lake Superior Power Company should give us the full amount of power which our canal is capable of developing. The Lake Superior Power Company owns the compensating works also. It has given rights to the receiver of the Michigan-Power Company in connection with that which entitled the Michigan Power Company to the benefit of them to the full extent to which they compensate. But, certainly, so far as the Lake Superior Power Company is concerned, it has compensated away above and beyond—approximately 10,000 cubic feet per second beyond, what it is actually using, because it has both the compensating works and it has, by the filling in of the natural channel alongside of its present canal, compensated approximately, as I understand it, 9,000 cubic feet.

COMMISSIONER WISNER: About how long before that additional power would be needed? I mean the full capacity that you speak of.

Mr. ROWELL: I could not with absolute accuracy say. I can tell you when the option must be exercised in connection with the 100 horse power, and that is, the parties have an option I think until the 12th day of December. They may exercise it any time within, but the option is up to that time, which calls upon us for 1,000 horse power. Now, under this section we could get new plans in and approved before that, but I say you would absolutely tie our hands. And let me say in this, I do not see what new plans you want from the Lake Superior Power Company. If it owns the present compensating works it has compensated above and beyond.

CHAIRMAN ERNST: Simply want to know what is what. The other company claims to own those compensating works.

Mr. SHAW: No, Mr. Chairman, I do not wish to be misunderstood. We do not claim to own them. They had to be built in Canadian waters and they built them there, and they allowed us to use them. Of course, I suppose we deal between the two companies, but there is no need of going into that and in that way we had the use of them.

CHAIRMAN ERNST: That is all right.

Mr. ROWELL: The receiver of the Michigan Power Company is entitled to the benefits with us.

CHAIRMAN ERNST: Certainly, but it cannot count twice.

Mr. ROWELL: Oh, certainly not. We can only ask under the present conditions the limit of the actual user, and that the two companies together should be entitled to the total compensation provided by the natural filling of the channel on the Canadian side and the compensating works now constructed.

Mr. SHAW: That was the point.

COMMISSIONER CLINTON: Mr. Rowell, have you stated what the capacity of the Lake Superior Power canal is?

Mr. ROWELL: 9,000 cubic feet per second.

Then coming to Rule 5, I would suggest, gentlemen of the commission, that that should say 'plans for the diversion or use of water', because it is quite possible to use the water in such a way as to lower the level of the lake without diverting it, by the lowering of the crest of the rapids or by increasing the present flow in any way, and if you add 'plans for the diversion *or use* of water must include such remedial and controlling works in the bed of the stream as may be necessary to maintain levels, and must provide a suitable passage for logs over the rapids,' you will work no hardship on anybody, because it is only to maintain levels, and you will protect the public interest by so doing.

Then there is just this question—it is a question for the gentlemen of the commission to consider, and perhaps you consider that under the existing rule you already have authority to decide where the location of those compensating works or controlling works shall be. I ask it as a matter of information. Is it the thought that the commission will decide where they shall be, or that if they are on the Canadian side the Canadian Minister, and if on the American side—

CHAIRMAN ERNST: This commission under these rules should approve plans, and that of course includes the location of the remedial works.

Mr. ROWELL: Includes the location? As long as that is understood, Mr. Chairman, why, then, I see no objection.

The next is 7:

'Permits to divert water for power purposes shall be for a period not exceeding five years, and at the end of that period shall lapse unless renewed.'

Does that apply to the existing diversion, or is that for further diversion, Mr. Chairman?

CHAIRMAN ERNST: All use of the water.

Mr. ROWELL: All use of the water—then I most respectfully make this suggestion,—the government of the province of Ontario, rightly or wrongly, claims that it has the right to authorize the construction of a powerful canal on the Canadian side, such as it did, and the town of Sault Ste. Marie in the first place purchased from the government of Ontario at a very substantial outlay the water rights there, which included the full right to that canal in perpetuity. The Lake Superior Power Company took over the rights of the town of Sault Ste. Marie on the payment of approximately $250,000, which carried with it what they understood to be the right to divert that water in perpetuity. Now, this is not the time or the place perhaps to enter into any discussion of the respective rights of the province and the Dominion in the premises. We are prepared to submit to any reasonable regulation, as I before mentioned, for the protection of shipping, but we cannot agree in view of the large investment we have made to submit to a proposition here which might seem in some sense to

terminate the rights for which we have paid a large amount of money; and on behalf of the Lake Superior Power Company I would have to object to any such limitation as that in clause 7.

Then coming to clause (d) of the rules, I do not know that there is any probability that in the working out of that clause, which is the existing regulation, any serious difficulty would arise. I just mention the wording of it for the consideration of the engineers, and if they think it is not necessary to modify it, why, perhaps not.

'When the monthly mean level rises above 603·0, the flow through the canals and remedial works shall be increased to their maximum capacity.'

Now, you will readily understand that in connection with the actual power operation, to compel a power company to turn on to its maximum capacity, the engineers tell me, might mean a lowering of head such as would materially interfere with the advantageous operation of the plant. That would not be necessary—I mean the chances of its getting about 603 under normal conditions, are not very great, probably, and by opening up the remedial works, the gates, the proper level could easily be gained, and it would not be necessary to exercise this right here given; and I do not suppose it would be arbitrarily exercised in any case, but in its present form it is open to that objection, that is all. I simply mention it for the consideration of the members of the commission.

I do not think, Mr. Chairman, there are any further remarks I have to make in connection with this matter.

Mr. Shaw: Mr. Chairman, I omitted one thing. If I may,—we do not wish to be put in that position, the Michigan Lake Superior Power Company, of consenting to a time limit in there by which our rights would expire, because the statute says that we may divert the water so long as we do certain things without any limit imposed upon us.

Another thing I wish to mention. There may be a misunderstanding from my statement that these gentlemen had not taken any action to stop our work. They did commence an action after our work was practically completed and while we were before Congress arranging these terms for diverting water. Then Mr. Chandler did file an action, but even then he did not insist; although he prayed for an injunction there, he did not insist upon it or undertake to stop us from putting it in; although he did commence an action asserting his rights while we were before Congress. It came to us at that time.

Mr. Goff: If the Chairman please, some remarks have been made in regard to Mr. Chandler here. In justice to him as a citizen, entitled to have them correct, I wish to say that his position,—while he is connected with the Chandler-Dunbar Water Power Company, has never been such as to warrant any one to suppose for a moment that the rights of the Chandler-Dunbar corporation were being sacrificed by him by reason of any aid that he gave to the other corporation; because, as I have already pointed out, there was never any understanding on his part that the water which was going to be used by the Lake Superior Power Company was going to be water which would affect the rights of the Chandler-Dunbar Company.

The next proposition is that some allusion has been made to his getting a string on this tract of land which is recognized by the American law as a proper proceeding, and it was contested all the way through the departments publicly, and after it has been contested and while the patent was decreed to be awarded he made an offer to the government that he would convey, if they wanted the land that they required for additional purposes for canal, away back in 1882 or 1883, and afterward he made other fair offers to the government.

Chairman Ernst: I do not think Mr. Chandler or his friends need to be disturbed about anything that has been said.

Mr. Shaw: That was purely a matter of history.

Mr. GOFF: I would like to file a copy of these letters, it certainly cannot do any harm to show that Mr. Chandler has never been in the slightest way disposed to prevent the government from protecting the interests of navigation or from building up the interests of navigation by canals.

Mr. DOW: Mr. Chairman, we are in the usual position of the man who speaks first, and if it be permitted that I, without discussing what has been said before by me, and very briefly along the lines of that discussion to what I have said, I would like to do so for about three minutes.

CHAIRMAN ERNST: Well, Mr. Dow, anything that will throw additional light on the subject, we will be glad to hear. Any personal reflections we do not want to hear.

Mr. DOW: Absolutely none. I hope, I may say, in bringing in certain distinct statements as to the past, it will be appreciated by this commission I brought them in to show why, after having intercepted water in two spans, we did not develop. That was why those were brought in.

Mr. Chairman, we admit the full force of the argument that each corporation should be allowed to utilize to the extent to which it has compensated; and, admitting that, we respectfully submit that we initially, and with full intent to continue development, compensated to the extent of interception of two spans of the International Bridge. We admit also the full force of the argument that the compensation performed by one corporation should not be diverted to the benefit of another. We therefore ask that we be ourselves allowed the full value of the compensation which we have made. That is substantially what I have asked for, that we be allowed an amount estimated as 6,000 feet, equal to the natural normal flow through those two spans.

As submitting light on our position, I state that when we put in those head works we expected to continue our development, and from causes broadly included in the litigation and opposition which we have encountered, we have been unable to continue to that extent even now, and the nature of that opposition I have pointed out to you, and also the fact that we are now, if limited to our 700 feet, placed in the necessity of operating a steam plant, and that is why we, after making this compensation are so late in asking that we be allowed to use it. We ask, gentlemen, that you give us the advantage of our compensation and that you do not give it to a company diverting water, which claims that because we made that compensation before they actually turned their water on, they are entitled to the benefit thereof.

Mr. GOULDER: Mr. Dow, are you not asking for that in advance of investigation?

Mr. DOW: We are asking, gentlemen, that now, pending full investigation, which we fully expect to assist, that the figure given in these rules be a figure approximately equal to the natural flow interrupted by our compensating works, and we estimate that at 6,000 feet, and state that figure not as a demand but as an approximation of that actual compensation made by us, of which we respectfully ask to be allowed the benefit, the argument in favour thereof being the one made by Mr. Shaw and by Mr. Rowell, which we fully approve of.

Mr. GOULDER: Mr. Chairman, if I may say a word before I go, there are two or three things I want to call attention to very briefly. One is this,—when the navigation interests were in Washington and this bill was under consideration, the first time the bill was gotten up, I venture to say we were there at least a week, quite a large delegation, and it didn't go through. Perhaps there was no River and Harbour Bill—I don't recall the reason why it didn't go through that time—it is unimportant. But the next time it came up the disposition of the committee was to have it go into the River and Harbour Bill and have it condensed,

and we had another long session with the committee and with sub-committees of that committee and the government rights alluded to by Mr. Goff, we did not take up, because we said the government was there, represented by its committees and officers and the Secretary of War and engineers, &c., and that they ought to be perfectly competent to take care of their own rights. We did not go into that. We were simply looking after the two-fold proposition, first, that the diversion of this water should not be permitted except upon regulations which would prevent that of itself interfering with levels and navigation, and, also, as their attorney has stated this morning, any international commission, assured at that time, although it was suggested and was alluded to in the bill,—it was required in that bill—well, as the result of the whole transaction, that the Secretary of War might turn on this water in the power canal in whole or in part whenever that in itself or in conjunction with any future works of the government or with any other canals, whether located in Canada or the United States, should be interfered with, the Secretary would have that authority and it was in that connection that we stated, not myself alone, but I think every one of our delegation from the shipping interests down there stated that we were not opposed to the personnel of the power canal company we had no feeling—Mr. Livingstone was down there, some of his friends were connected with it; one member of the Lake Carrier's Association had a good many friends who were in it, and we hadn't any feeling, and assured them we hadn't any feeling of that character at all, and that when something came forward again and our attention was drawn to it which might in conjunction with other canals, if put in operation, require the Secretary of War to shut off the water, that they would find us, all the navigation interests of the Great Lakes, opposing that in the same sense and to the same degree that we were opposing the Michigan Power Canal Company; that is to say, opposing it except there be before a drop of water were diverted, before any conditions were changed, a thorough and complete investigation, and that some governmental authority, which we preferred might be a commission of this description, a mixed commission from the two countries, should give its full approval, and that it should not be a mere estimate or statement of some interested party whatsoever, but that it should be the expert opinion of men disinterested, appointed by the government, and, as we thought and said at the time, preferable by both governments. I said this morning that I was alarmed when I heard statements made here on behalf of this project. I heard the question mentioned as to how the condition is to be remedied, either of lowering or overflowing, and I find now this afternoon, when the more specific facts come, a proposition to increase the flow from 700 feet per minute to 6,000, feet through the same superficial area, through two pier spans, and the proposition that in advance of any investigation there be permission to go fifty per cent beyond the projected works, which already are six times beyond the present condition. As I hear this I am bound to say that more and more do I become impressed with what everybody says on either side of this, that a commission ought to go very slowly about this thing, and I would feel a great deal better if some condition could be made by which there shall not be any taking up of the water in the manner proposed; at the same time repeating what I said this morning, that I do not think any injustice ought to be done Mr. Dow. If his company or the lessor company owns the property, if they have rights there which are valuable, they ought to be compensated. That is the theory of our government, the theory of justice in this country, and that should be done. Now, if this lies on the American side, then the United States should take care of it; if it is on the Canadian side — where such a thing occurs on the Canadian side, it would seem as though the Canadian government should take care of it, or else through this commission should agree upon some proper basis.

CHAIRMAN ERNST: Mr. Goulder, what specifically do you criticise or object to in these rules and regulations?

Mr. GOULDER: I have not gone into that, Genl. Ernst, at all. I was much impressed with the objections of the canal company to the permission of 4,000 feet, which would simply permit, as I gather here as the result of some questions, would permit the full completion as at present projected of all these works of the Edison, Chandler, whatever company it is, out in the rapids. I have not hesitated to say from the outset that I think the navigation interests are bound to put their influence against any permission of that character being given in advance of exactly the same kind, or an equivalent kind, of precaution that was taken before any water was permitted to be diverted.

CHAIRMAN ERNST: We have a situation here. The money in there; they have invested their money; they are using the power, and there are 60,000 cubic feet of water available that is running away, isn't needed by navigation. There is rather more than that at present, but about that. Now, we are trying to do justice to all parties concerned, and above all to protect the navigation interest. We are allowing here altogether 19,500 cubic feet of water, which is one-third of the water that is running away, isn't used by anybody. I would like very much, if you can point out where any interest is endangered in those rules and regulations, that you would do it.

Mr. GOULDER: Well, that becomes a technical question. I have heard an engineer state here this morning that there would be 2-10 of a foot reduction by allowing that 4,000 feet flow in addition.

CHAIRMAN ERNST: That is a fundamental rule that we start with from the beginning. The use of that water is subject to rules already existing which require levels to be maintained.

Mr. SHAW: But, gentlemen, may I suggest right there that until you have gone in and adopted something they want this temporarily, those regulations to protect levels are on us. Now, you start in with a level based on the present condition, as it has existed recently. Now you permit a change to be made until there is some new compensation, to keep it at that. Either you start in with a wrong level which we ought not to maintain, or you put upon us the maintenance of that 2-10 of a foot temporarily.

Mr. GOULDER: We have had this difficulty, Genl. Ernst, and that is why the navigation interests are so sensitive about all these matters. We have been, —Mr. Livingstone, about how many years getting those tunnels out of Chicago river?

Mr. LIVINGSTONE: Oh, ten years.

Mr. GOULDER: At least ten years. I have myself appeared I think at least three times before Congressional committees, and I think that there have been many more than three appearances. I think I personally have been there three times; and there was the navigation of Chicago hindered very, very seriously. You see, they were built at a time when, just as we are now looking, just as we have always done in these navigation interests, looking not sufficiently to the increase, and they thought they had it down low enough for all time, and found out it cost about ten cents a ton more to get coal up the Chicago South Branch than it did down at the lower river because of those tunnels. Now, it took us ten years to get those tunnels out; and in Cleveland, which I can speak about better than other places, we have been trying for years and are gradually getting the centre piers out of the river, and I notice by the morning paper in Buffalo this morning that in order to test the question the Secretary of War has ordered the arrest of the County Commissioners at Ashtabula, where our interests have

been engaged in the last ten or twelve years more or less in an effort to get a bridge out of the place. The county commissioners were enjoined in the state courts, and the Secretary of War has ordered their arrest in the effort to find out what they are going to do about it. That is why we are so conservative about getting these things in. Investigate first.

CHAIRMAN ERNST: Here are some specific rules. How will they injure navigation? There is the point.

Mr. GOULDER: Well, if it is true that the increase to 4,000 cubic feet there carries with it even a slight possibility of a reduction of level, those ought not to go.

CHAIRMAN ERNST: We will assume that is not true.

Mr. GOULDER: Then, Genl. Ernst, I say this, that the commission should determine that that is not true. They should have an investigation, a thorough, careful, complete investigation first, and let it be this commission that reaches a point where it is able to send out its statement to the navigation interests. You are invested by Canada and the United States with a great trust common to both these countries, and your Canadian members know how by leaps and bounds they are increasing in Canada in navigation, how much larger that is getting relatively as well as in tons. Now, it should be, in my judgment, understood that when this commission is ready to put itself on record before both countries that what they permit is not going to do harm, and that then only permit should be given.

CHAIRMAN ERNST: We are trying to get light on that very subject.

Mr. GOULDER: My objection is to allowing that in advance.

CHAIRMAN ERNST: But we are trying to make up our minds on that now.

Mr. GOULDER: Well, I can't help you, General, on that engineering point, because my opinion is worthless.

COMMISSIONER CLINTON: The idea, I think, underlying what Mr. Goulder has said, is this, that the temporary allowance under Rule 4, from four to six thousand feet per second, whatever the capacity of the head works may be, is practically approving the entire plan of the Chandler-Dunbar Company now under way, and that that amounts practically to an approval of the construction of those works of the Chandler-Dunbar Company. Now, this is not my idea, it is what I think is the idea that he has in mind.

CHAIRMAN ERNST: Then the objection is to that allowance, of 4,000 cubic feet?

Mr. GOULDER: I very earnestly do object to that in advance of such an investigation as will enable the commission to put itself on record with satisfaction to itself, after such an investigation as the commission believes is sufficiently thorough to justify it in taking that responsibility.

CHAIRMAN ERNST: That is just exactly what we are engaged in.

COMMISSIONER MABEE: It has been stated here, Mr. Goulder, and has not been contradicted, that the up-stream terminus of the Chandler-Dunbar works is a thousand feet below the crest of the rapids, and that at the crest of the rapids they are in no way enlarging the cross-section of the river. If that be so how can their work lower the water in the river or in the lake?

Mr. GOULDER: I cannot give you an opinion on that because I don't know the technicalities of it well enough to answer that question. I only know what I have heard the engineers say, and that I heard the statements made here to-day by one engineer that the increasing of that flow in the manner proposed up to

even 4,000 would cause a reduction of 2-10 of a foot, and 6,000 would cause a reduction of a third of a foot.

COMMISSIONER MABEE: Mr. Shaw stated that upon the authority of his engineers, and I was surprised, if Mr. Dow's statement is accurate about where his work begins, that it was not contradicted.

Mr. GOULDER: Of course, you will excuse and forgive me for not giving an opinion upon that technical proposition. I only say these things because I have heard them stated.

COMMISSIONER COSTE: I understand that in the present condition of the river the water does not pass through spans 1 and 2.

COMMISSIONER MABEE: We have been told over and over again during the progress of our investigation that if you do not touch the crest of the river you cannot interfere with the level of the lake.

COMMISSIONER CLINTON: That is assuming that the velocity of the discharge is not increased below.

CHAIRMAN ERNST: Oh, yes, that is a complicated question, but what I want to get at from Mr. Goulder and Mr. Livingstone is if there is anything in these rules and regulations that is objectionable to the navigation interests.

COMMISSIONER CLINTON: I think these other questions can be disposed of.

Mr. GOULDER: Well, the objection that I see is on the statement of Mr. Dow.

CHAIRMAN ERNST: No, but I am assuming that there is no reduction in levels. There is the fundamental principle.

Mr. GOULDER: Then the only objection is the one that has been stated by the Executive Committee of the Lake Carriers' Association, of the necessity of having that property out there for navigation purposes, and the objection to permitting anything to go there; and I should say that there might be a fundamental objection to giving any permission by the rule or regulation to any extent whatever; and if I were a member of the commission I should hesitate a pretty good long time and consider it mighty carefully before I would appear to validate under all those circumstances a use of that character.

CHAIRMAN MABEE: We have been hesitating now for six or seven months, Mr. Goulder.

Mr. ROWELL: Might I add one word, Mr. Chairman, in answer to Mr. Mabee's question about the lowering of the lake by that extra diversion I think Commissioner Coste answered it. The present level there grows out of the conditions existing in the river below the crest of the rapids. The effect of the change is that only 700 cubic feet per second flows through spans 1 and 2. It is due to local conditions in the rapids below the crest, as I understand it. Now, if you change these local conditions below the crest so that you draw off between spans 1 and 2 instead of 700 cubic feet per second, 4,000 to 6,000 cubic feet per second, the inevitable result is a lowering of the lake.

COMMISSIONER MABEE: Doubtless it must be, because the statement has not been challenged by the representatives of the Chandler-Dunbar interests.

Mr. DOW: Mr. Chairman, I respectfully submit that it was challenged.

CHAIRMAN ERNST: Mr. Dow made this statement, that they took the natural stream and obstructed it by this dyke so that only 700 cubic feet could go down between those two spans, where naturally, without the dyke there would have been a great deal more; so they compensated, raised the level of the lake; they practically restore the amount that would naturally go down.

COMMISSIONER MABEE: Yes, I understand that, Mr. Chairman, but Mr. Shaw says upon the authority of his engineers that this 4,000 feet will lower the level of the lake three or four inches. Now, do you admit or deny that?

Mr. DOW: Mr. Chairman, in answer to Mr. Commissioner Mabee we are putting more than 700 cubic feet through that, because there is a very considerable leakage which is capable of being stopped, which has been to some extent stopped for the purposes of our present works. The inevitable result, as pointed out by Mr. Shaw, speaking for his engineer, of our restoring the normal flow through spans 1 and 2, by utilizing according to our intent when we intercepted those spans, that same normal flow, will be some lowering of the present levels. We respectfully submit, however, that that lowering of the present levels will be a restoration of normal conditions from conditions which are at present and temporarily abnormal, and that therefore it is within the principle laid down very ably by Mr. Shaw and by Mr. Rowell, that the use should be equal to the compensation; and we also submit that that compensation was made by us at our expense for our purposes; that our delay to utilize the original compensation is not due to laches in any way, and that we are in equity, without any reference whatever to prior legal rights, which I have carefully refrained from speaking about,—that we are in equity, having made that compensation for our own purposes and used due diligence in trying to utilize it, entitled to utilize that compensation. I think the position is clearly understood by the commission.

CHAIRMAN ERNST: I think so. I think we all understand it.

Mr. DOW: You cannot let it go beyond that, and I thought it hardly necessary to enlarge upon it.

CHAIRMAN ERNST: We are very much obliged to you gentlemen for your very interesting and learned discussion here, and unless some one else cares to address us farther, we will consider this meeting closed so far as the Soo matter is concerned. Mr. Livingstone has another matter that he would like to present to the commission. Does anybody else care to speak further with reference to the Soo?

Mr. ROBERT GRAY: Mr. Chairman, I feel like Mr. Goulder does. I do not like to see permission granted in the line suggested. Perhaps this might assist. If you feel that there are rights that should be protected by permission being granted temporarily, should it not be under some conditions and agreements as were made by Congress with the other company, namely, that they should acquire no rights but such as could be revoked by the commission at any time, and that no rights of estoppel, or of a paramount character, should be acquired by reason of any permission which might be granted temporarily by this commission? I merely make that as a suggestion.

COMMISSIONER CLINTON: The commission have already considered that, and will consider it when they come to it.

Mr. LIVINGSTONE: Mr. Chairman, I trust you will pardon me for a moment. The great anxiety and fear of the Lake Carriers' Association, which comprises over a million and a half tons now, and practically takes in all the freight capacity of the lakes, at least to a very large extent is that these interests may not be adequately recognized. 'The best laid plans of mice and men gang aft aglee.' We have all heard here the opinions of the engineers, and they are doubtless thoroughly competent to cover all these points, and I have no doubt they feel entirely sure of their ground, and we have great confidence in the commission One thing that has given me more comfort and satisfaction than anything that has come up during the session has been the reiterated statement of General Ernst, which of course represents the views of the commission, that the fundamental principle by which all things are to be governed is that the level of the

lakes will be absolutely maintained, and that that is to be the paramount question above all things, and that no question will be considered which interferes with that. Of course, when people have not had the experience and the knowledge that the engineers have had, when you bring up a discussion such as you have had to-day, with learned arguments on both sides, it naturally does not entirely remove the feeling, the natural fear, you have in regard to something upon which you are not fully posted. The Lake Carriers' Association, of course, you will understand, provided there had been no works constructed on the St. Mary's river, would not have had this fear of possibilities,—we will put it that way,—the possibility of the lowering of the water. That question would not have come up. Naturally we feel that we could have been safer had there never been any works put in the river. And with the tremendous leaps and bounds with which our commerce has grown, it has gone away beyond the flights of the wildest imagination. In fact, the dream of to-day has been the reality of to-morrow. You take the 'Wolvin', for instance, which I merely speak of as an illustration,—I will be very brief,—that vessel jumped the record of carrying capacity 3,500 tons in one jump and created a new era. Since that time some fifty boats at least, if not more, have been completed, those that are not completed being under contract and under construction and ready to come out the first of April, and the smaller boats are fast becoming obsolete and will as rapidly as possible become a thing of the past, because it is impossible for the smaller class of boats to live and compete with the present tonnage; and when you stop to consider that in the short space of ten or twelve years boats that were launched at that time, the biggest of that craft are now very small boats, some of them so small that as a matter of fact if they were presented to you as a gift with the understanding that you were to keep them in condition and run them, you wouldn't accept them because you would be very much in the situation that the Sultan of the Orient placed one of his courtiers to whom he wanted to make a present and gave him an elephant. Being the gift of his sovereign he couldn't sell it, and he couldn't give it away: therefore he was compelled to keep it, and the expense of feeding it ruined him.

In 1843 Senator John Gorman, the first senator from the State of Michigan, introduced a bill in Congress for the appropriation of lands for the building of the Soo canal. Henry Clay, then in the height and zenith of his statemanship and influence at Washington, ridiculed the proposition and claimed that the scheme was chimerical and beyond the bounds of civilization. In the short space of 62 years you will all know what has been accomplished. You know that even in the short space of five years the largest increase on the lakes has occurred. The tonnage has grown in the last five years I think at least sixty per cent, seventy-five per cent of it has grown up in the last ten years. When the Soo lock was opened the entire tonnage of the lakes and almost the hulls themselves would not be beyond the capacity of one of our large modern steamers of to-day, the ten or eleven thousand tonners. We had losses here a short time ago in a heavy gale that swept over the lakes about which doubtless all of you read, in which some 16 or 17 boats were lost. They were all of the older class of boats with the possible exception of the 'Caliyuga', and she was not a new boat by any means. I figured up the tonnage of those boats that were lost,—I did it before the 'Caliyuga' was lost. Their total tonnage only amounted to 9,685 tons, less than the tonnage of one of the new modern boats which are coming out to-day. When you stop to consider the question for a moment, the lowering of the water to the slightest appreciable extent, even the thousandth part of one per cent, you see it means a great menace, and naturally we fear it. Take a modern 10,000 tonner, she will average on the draft of water which we have had this year —I do not speak accurately, but taking it as an average, she will average about 100 tons to the inch in carrying capacity. Naturally, of course, the last inch she will carry more than she will any other inch. I won't take the time to explain

the reason. The result is that if any difficulty should come up, for instance, if through a mistake in the calculations of the engineers or in any other way there should be some miscalculation by which the water were reduced three or four inches, you can readily see, even on the present tonnage, what an enormous loss that would entail on navigation if there should be a reduction of several inches, with an average of a hundred tons or more per inch; and our new tonnage is going to be on a basis double that of the present, if nor larger. I merely speak of this to emphasize the reasons why the Lake Carriers' Association are so terribly in earnest over this matter and are so exceedingly anxious that there should be no mistakes. I want the commission to understand clearly that it is not because we doubt the wisdom or intelligence in any way of the commission, I am more satisfied to-day than ever, after the expressions that have been made. that the utmost care and caution will be used. At the same time you must concede to us, that we cannot help but have a certain amount of apprehension until the thing is absolutely settled.

There is another point that comes up quite strongly in this matter, and that is this. We know that it is an absolute certainty that we have got to have in the near future at leats two more locks. I am not going to pretend to say what the future may be, because I think the man that would be bold enough to predict to-day what the future of the commerce on the lakes will be in the next fifty years would probably undershoot the mark just as much as did Henry Clay 62 years ago, and therefore the possibilities are so great that our apprehension is naturally increased to that extent. You will pardon me for trying to emphasize the great need, the almost superhuman necessity as it were, for caution in every step that is taken in this matter. The Lake Carriers' Association were infinitely pleased when this commission was appointed on the lines on which it has been appointed. Perhaps I misunderstand its powers somewhat. I had believed right along that you had full power. Some remarks that have been made to-day have raised a doubt in my mind as to whether that was clearly understood, as to whether by the act creating the commission you had full powers in that direction. Whether I have been mistaken or not, I have supposed,— and I know that is the belief of a great many of the vessel men and those interested in navigation,—and it is not confined to vessel men, for there are a great many interests that are concerned in it,—I supposed, a great many others have supposed, that this whole matter would practically be turned over to you. If you found that anything had been granted in the past that was going to militate against these interests of navigation and commerce in the way of reducing the water, that you would have the power to alter it and amend it. In other words, that to a certain extent at least you would have retroactive powers. Possibly I am mistaken. But if that is not the case it certainly would be all the more reason why the greatest possible care that human precaution and foresight could exercise would be taken in any move of the future. You understand that we as an association cannot recognize individual interests. I do not pretend to talk about the merits or demerits of either one company or the other. The only point that we want to be made here is this, that whatever is done, the levels of the lakes shall be maintained above and beyond all things.

I will not take up your time any further on that. I thank you for the time given.

I want to call the attention of the commission to a matter entirely foreign to this subject. You, gentlemen, are all aware that the Michigan Central Railroad has obtained permission from the Canadian government and the United States government to construct a tunnel under the Detroit river. One of the provisions is that there should be at least 40 feet of clear water above the tunnel. The Lake Carriers' Association have not of course the slightest objection to the tunnel. As a matter of fact, had there been any difficulty about it we would have been very glad to have assisted them, if such assistance would have been of

any avail. Paradoxical as it may seem, the greater business that the railroads do, the greater business we do. The railroads carry freight to the shipping points at the upper end of the lakes. We could not get the freight if they did not. They bring it from the great Northwest, we carry it east, and it is loaded into cars and shipped again; so that instead of being inimical, as many of them have supposed, the interests of navigation are just the reverse. I am merely emphasizing this point in connection with what I propose to say a moment later. Therefore, so far as the tunnel proposition is concerned, we, the Lake Carriers' Association have no objections to the railroads honeycombing the St. Clair and Detroit rivers from Lake Huron to Lake Erie. With this proposition to build a tunnel across the Detroit river, the suggestion came up that they might want to do this,—you understand that it is tentative yet—it is not decided upon,—but it was submitted as one of the ways in which they might possibly want to build this tunnel across the river,—that was, that they might want to built it from the top, that they might want to build it by driving a double row of piles in the river 600 feet in length at sufficient width apart to admit of their digging a trench between the piles and sinking tubes. The tunnel, as I understand it—I do not speak positively now,—I understand the tubes are to be 23 feet in the clear, that is, the tunnel is to be, and whether they are to be of cast iron, steel or cement, that I do not know. The river at that point is, roughly speaking, from dock line to dock line, where they propose to build this tunnel, about 2,000 feet; so that, roughly speaking, during the time they were building this tunnel they would occupy or block so to speak, about one-third of the navigable space of the river. I want it clearly understood that there is no certainty that they will adopt that method, but I felt that it was my duty as president of the Lake Carriers' Association, to call the attention of the commission to one of the plans that has been suggested for building it. We believe that if that plan were adopted and they were allowed to do that, that it would be quite a serious menace to navigation. Passing the Detroit river now with its myriads of lights and smoke and one thing and another, it is one of the most difficult pieces of navigation in some ways that we have from the upper lakes to the lower. It would be necessary for them, of course, before doing this, to get the consent both of the Canadian and the American governments. I want it clearly understood that no decision has been arrived at. I merely speak of it as presenting so to speak a sort of caveat, to your commission, so that in case the question does come up before you, you will be advised of what they propose to do. Not being an engineer I do not presume to pass on that, but it would seem to me, taking our experience with wrecking into account, and one thing and another, and the fact that so much of that work would have to be done by divers,—at least it would seem so,—it would seem to be a very expensive method. I am hoping, and I think the balance of the Association are hoping that they will adopt some other method, by which it will not be necessary for us to come into apparent antagonism to the railroads, because we would like very much to have them build a tunnel the way they want to and just as they want to, providing in doing so, for the sake of saving to themselves quite an amount of money, they do not incur on lake navigation interests a cost of a large amount of money to enable them to save some. I felt that I should call your attention to it at this time so that you would be advised of it in case the question came up, and give it the most careful consideration. I thank you, gentlemen, for the time you have given me.

COMMISSIONER CLINTON: Mr. Livingstone, may I ask you at what precise point they propose to place the tunnel?

Mr. LIVINGSTONE: I am not positive about it, but at present the suggestion is to start on the American side between Twelfth and Fourteenth streets and run it a little diagonally up the river across to the Canadian shore, the chart shows a little more water than I had given there, but I have roughed it at about 2,000 feet, taking it from dock line to dock line.

I rather disliked to bring this up for the simple reason that every time anything has come up, there has been a sort of disposition on the part of the roads to claim that we were inimical to everything which pertained to the railroad interests. That fact is that we not only are not opposed to it, but on the contrary are anxious they should have all the facilities that they can possibly have, provided, of course, they do not get these facilities at our expense.

Commissioner Clinton: I think I can appreciate that because the same thing was said when we were discussing the Erie canal.

Mr. Livingstone: While you are speaking of the Erie canal, Mr. Clinton, I must call your attention to one thing. That was called 'Clinton's Ditch.' The year before they opened the Erie canal the freight rate from New York to Buffalo was $86 a ton, and immediately after they opened the canal it fell to a little below $9 a ton.

Chairman Ernst: The hour is getting a little late. Do any other gentlemen have anything to say on this question? If not, the public meeting will be closed.

Papers filed by Mr. Goff.

Letters of Wm. Chandler and Chandler-Dunbar Company to Officers of the Corps of Engineers, U. S. Army, regarding lands required for canal purposes.

Sault Ste. Marie, May 19th, 1883

Major F. U. Farquhar,
Corps of Engineers, U. S. A.,
Detroit.

Major:—Referring to correspondence between Mr. E. S. Wheeler and yourself concerning a tract of land on the north side of the canal between it and the rapids, located by me with Porterfield scrip at the local Land Office at Marquette, Mich., June 3, 1880, and which is now pending on appeal before the Hon. Secretary of the Interior, I will submit the same proposition to you, that I made verbally to your predecessor General Weitzel, regarding the terms upon which the United States could secure a title, providing the appeal proceedings are decided in my favour.

1st: Should the United States wish to secure this tract of land for canal purposes, I will make deed to the same for any compensation that you and Mr. Wheeler may after an investigation of all the facts concerning my location of the same, deem just and equitable.

2nd: Should the United States only desire the title to the lower end of the tract I will deed that portion of it without compensation.

The above is the same proposition made to General Weitzel except that your name and Mr. Wheeler's are substituted for those of General Weitzel and Mr. Noble.

Respectfully,

Wm. Chandler.

Copy of letter addressed to Gen. O. M. Poe, Corps of Engineers, U. S. A., Detroit, Mich., Dated Dec. 14, 1892.

Dear Sir:—We have the honour to address you at this time for the purpose of calling to your attention our present and anticipated improvements on property lying between the St. Marys Falls Ship canal at the rapids of the St. Marys river. This property is now owned by the Chandler-Dunbar Water Company and partly by the Edison Sault Electric Company. We would also state that these two corporations are composed almost entirely of the same shareholders, so that there can be no conflict of interest between them in any negotiations that might be made. The property referred to, as you are undoubtedly aware, is composed of a strip of land bordering the north side of the Government Canal Reservation something over 1,200 feet. Upon this strip of land we have developed a water-power and installed an electric light plant which is now in successful operation. We have also extended our improvements north into the rapids, somewhat beyond the meandered line of our property, having first obtained a permit to do so from the proper Government authorities. We hope and expect to yet further develop our water-power and improve the property as the growth of the place and the business interests may demand or seem to justify.

In this connection it has been called to our attention, and we have observed that our present possession and development, so close to the Canal Reservation, might in the future, both inconvenience the proposed extensive improvements, which may be required upon the Government canal, and also embarrass ourselves in the work which we wish to do. While we are anxious to utilize to the fullest extent our property, we do not desire to be found in the way of the enlargement of the Government canal, or to do any more work of a permanent nature upon the land that in the future the Government may need. We recognize that thus far we have received fair and liberal treatment from Government officials, every privilege we have asked, and our work seemed to require, consistent with a careful protection of public rights and interests, have been granted. Actuated by these considerations, we are led to ask if some plan of negotiation cannot be affected which might lead to an exchange mutually beneficial?

The rapids of the St. Marys river, beyond the Government improvements are not navigable and we submit are not and never can be of any possible use for navigation or commerce. As we understand the law, it is with a view of protecting these interests that federal legislation has given the general Government control over public waters, yet we recognize that an extension into the rapids should only be made after permission is obtained from your department. We are ready to enter into, and hereby propose for your consideration negotiations looking to an exchange of a strip of land 100 feet wide from the south side of our property, and adjacent to the Canal Reservation, for Islands number one and two situated in the rapids of the St. Marys river, together with the privilege of extending our wing dams, or building new ones farther towards the centre of the river, not farther than the fourth pier of the International bridge, and constructing a tail-race below and outside of Island number three to the level of the water of the river below the rapids. As our original water-power canal, power house and electric light station are now located upon the lands which the Government would acquire by the proposed exchange, we would desire a lease for a nominal rent of that property, until we could reconstruct our works further out, or until such a time as the Government might require the same for its use.

We submit that such an arrangement as above outlined would be in harmony with the well known policy of our Government to encourage and foster private enterprise and development, in so far as the same are consistent with the protection of public interests, and we believe that it would work mutual benefit and convenience to both the negotiating parties.

As we understand it these results could only be secured through enabling legislation which would be contingent on the approval and recommendation of your department.

Should a proposition such as is herein outlined meet with your approval, further details, if any are desired, could be easily arranged.

We remain, sir,

Yours most respectfully,

THE CHANDLER-DUNBAR WATER POWER COMPANY.

By WM. CHANDLER.

Copy of letter addressed to Mr. Joseph Ripley, General Supt. of St. Marys Falls Canal and Engineer in charge. Dated Sault. Ste. Marie, Mich., Oct. 26, 1901.

DEAR SIR: Referring to our recent conversation regarding the desire of the Government to obtain from the Chandler-Dunbar Water-Power Company, certain lands to be used for the widening of the ship canal, situated in the city of Sault Ste. Marie, Chippewa County, State of Michigan, described as follows:—

Beginning at the point of intersection of north boundary of Canal Reserve with the north side of Portage Street:—

Thence south 89° 42′ west 982 feet.
" " 81° 25′ " 101 "
" " 89° 42′ " 16 "
" north 82° 01′ " 101 "
" south 89° 42′ " 589.57 feet to point of intersection with west boundary line of claim 95, thence along said boundary line south 45° 13′ west, 22·68 feet, to intersection with north boundary line of Canal Reserve, thence along north boundary line of Canal Reserve south 74° 54′ east, 276·54 feet. Thence south 87° 16′ east 207·90 feet. Thence north 85° 23′ east 1,333·20 feet to place of beginning, containing 2·26 acres more or less.

I would say that the Chandler-Dunbar Water-Power Company claims to be the owner of Islands No. 1 and 2 in the St. Marys River at the Falls thereof. I believe that the Government claims to be in constructive possession of the said islands under executive order, dated October 12, 1889, which purports to reserve them, together with other lands for canal purposes.

The Chandler-Dunbar Water Power Company is desirous of holding possession of the islands aforesaid without litigation, and it makes this proposition: In consideration of the United States abandoning its claim to, and leaving the Chandler-Dunbar Water-Power Company in undisturbed possession of said islands. The Chandler-Dunbar Water-Power Company will, within ninety days, deed by warranty deed to the United States the land above described, as desired by it, excepting so much thereof as lies within the boundaries of Private Land Claim Nos. 3, 95 and 96, and as to so much thereof as lies within the boundaries of the last mentioned claims, the Chandler-Dunbar Water-Power Company will give quit-claim deed.

As the land desired by the Government covers certain ground upon which is located a railroad track and cuts off connection between lands owned by this Company on the east and west side of the right of way of the International Bridge Co., I should wish the matter arranged in such a way that we have a railroad right of way past the north pier of the railroad bridge to our lands on the west, also the construction on the part of the Government, when the canal

is widened of a railroad embankment connecting our siding to the main line of the railroad, in place of the one we would lose by a transfer to the Government of the lands above described.

Accompanying this is a map showing lands of the Chandler-Dunbar Water-Power Company, desired by the Government and the islands aforesaid, and also a short memorandum of a few of the authorities showing the basis of the claim of said company to said islands by which the Attorney General can refer to the law relating to islands in the State of Michigan situated as these are.

Very truly yours,

(Signed) Wm. Chandler,

President.

Exchange 50-ft. strip adjoining St. Marys Fall Canal for Islands 1 and 2 in St. Marys' Rapids.

ENGINEER OFFICE, U. S. ARMY.

Detroit, Mich., Feb. 28, 1902.

The Chandler-Dunbar Water-Power Co.,

Sault Ste. Marie, Michigan.

(Through Mr. Joseph Ripley, Ass't Engr.)

Sirs: Your letter of October 26, 1901, to Assistant Engineer Joseph Ripley, in local charge of the St. Marys Falls canal, was duly received at this office, offering to deed to the United States certain lands adjoining the St. Marys Falls canal in exchange for the relinquishment by the United States of the latter's right of claims to Islands 1 and 2 in St. Marys River rapids.

After having duly considered the question at issue, I have herewith to state that your offer will be forwarded to Washington recommended for approval, providing that your deeds will be so modified as to cover a strip of 100 feet width on the north side of the north boundary line of the canal reservation, instead of one of 30-ft. width on the north side of the face of newly proposed pier, as originally offered by you.

The description of property covered by the 100-ft. strip referred to would be as follows:—

Beginning at the intersection of the north boundary line of the canal reservation with the principal meridian of Michigan; thence along said boundary line of canal reserve as located and described by the Whelpley survey of 1854 and 1855, north 85° 23′ east 2,449·26 feet; thence along the easterly boundary line of the Chandler and Dunbar lands north 4° 37′ west 100 feet; then south 85° 23′ west 2,990·94 feet to point of intersection with south boundary line of claim 95; thence along said boundary line, which is also the north boundary line of canal reservation, south 74° 54′ east 217·57 feet; thence south 87° 16′ east 207·90 feet; thence north 85° 23′ east 130·68 feet to place of beginning. And containing six and one-half (6½) acres, more or less.

In this connection it is to be understood that the deeds from the Chandler-Dunbar Water-Power Co. to the United States are to be warranty deeds so far

as the present ownership lies entirely in the hands of the Chandler-Dunbar Water-Power Co., and quit-claim deeds covering the entire rights of the Chandler-Dunbar Water-Power Co., where such ownership is merely partial; and it is also to be understood that the use of Islands 1 and 2 by you for manufacturing or other purposes, and the arrangements allowing you the railroad right of way and railroad embankment suggested in your letter of October 26, 1901, as well as other arrangements allowing you a further right of way for a railroad track south of the north abutment of the swing bridge, will all receive the favourable recommendation of this office.

Very respectfully,

(Signed) W. H. Bixby,

Major, Corps of Engineers, U. S. A.

EDISON SAULT ELECTRIC CO.

Copy of the letter addressed to Major W. H. Bixby, Corps of Engineers, U. S. A. Detroit, Mich. Dated Sault Ste. Marie, Mich., March 15, 1902. (Through Mr. Jos. Ripley, Ass't Engineer).

Dear Sir: Your communication of Feb. 28 in reply to mine of Oct. 26, 1901, to Mr. Jos. Ripley, Ass't Engineer is at hand and has been carefully considered. I find that it will be impossible on account of contracts with other parties for the use of power and erection of buildings to arrange for the transfer to the United States of the land exactly as you have described. I have endeavoured as nearly as possible to meet what I understand to be the requirements of the government, which is an area of land, sufficient to give room for the government to construct a lock north of the Poe lock. This land is shown upon the accompanying blue print and is described more particularly as follows:

Description:

Beginning at the intersection of the north boundary line of the Canal Reservation with the Principal Meridian of Michigan, thence easterly along said boundary line of Canal Reservation as determined by the Whelpley survey of 1854 and 1855.

North 85° 23′ east 2,449.26 feet, thence along the easterly boundary line of the Chandler-Dunbar Company's lands

	North	4° 37′	West	130.00 feet.
Thence	South	79° 39′	"	500.00 "
"	"	85° 23′	"	1,634.20 "
"	"	81° 25′	"	195.81 "
"	"	89° 42′	"	16.00 "
"	North	82° 1′	"	240.00 "
"	South	89° 42′	"	431.32 feet, to point of intersection with

west boundary line of Private Land Claim 95, thence along said boundary line.

South 45° 13′ west 51.26 feet, to point of intersection with north boundary line of Canal Reservation, thence easterly along said boundary line.

South 74° 54′ East 276.54 feet.
Thence " 87° 16′ " 207.90 "
North 85° 23′ " 130.68 ", to place of beginning, containing six and three hundredths (6.03) acres more or less.

The disposal of such a strip of land will compel this company to go to a large expense in moving all our proposed works further into the river, rebuilding and removing wing dams or dykes, and in filling out from the shore to secure necessary land or take the place of this. In consideration of the increased amount of land you ask for, I would desire to modify my proposition of October 26, 1901, to include in addition to the relinquishment of claims to the Islands No. 1 and 2 mentioned, also the relinquishment in the same manner of any claim the government might possibly have, on that part of Portage Street lying north of the government reserve as shown on Whelpley map of survey.

The blue print also shows a steam boat dock which has been partially constructed by the company. This dock is claimed by the assistant engineer here to be partially located upon the riparian ownership of the government. To do away with any controversy upon this subject, we desire a permit to complete and use such docking facilities at this point as our business demands.

As previously stated the land desired by the government covers certain grounds upon which is located a railroad track. I should desire the construction on the part of the government, when the canal is widened, of a railroad embankment connecting our siding to the main line of the railroad, in place of the one we would lose by a transfer to the government of the lands above described.

It is also understood that, in the transfer of the lands to the government, the riparian ownership of the lands beyond the line transferred to the government shall remain in the present ownership.

We also enclose under separate cover application for a license or permit to extend our proposed water power-works farther into the river and to construct the necessary tail-race.

In accordance with this understanding, we will transfer to the government the lands above described, in accordance with our letter of Oct. 26, 1901.

We would desire to occupy the lands not immediately required by the government under a lease for nominal rent, until such time as this company can get its work constructed farther out into the river.

Respectfully,

The Chandler-Dunbar Water-Power Co.

Per William Chandler,

President.

APPENDIX 'V.'

(*Translated from the original.*)

THOMAS CÔTÉ, ESQ.,
Secretary International Waterways Commission,
Ottawa, Ont.

SIR,—At your request I went to Niagara in the latter half of October last. The object was, as you had written me a few days before, to determine whether the cataract will continue to recede at a rate equal to that observed since 1842.

There is no need to point out that a problem, to which geologists have already given years of work without having attained an absolutely certain result, could hardly be solved by a few day's study. However, my visit to Niagara was very useful to me, inasmuch as I could thereby verify *de visu* the facts already published, to say nothing of the personal observations which I was enabled to make.

The result of my studies upon this question is briefly summarized in the report which I now have the honour to submit. You will observe that of the authors whom I quote in my paper, not one is Canadian. I thought this would be preferable, with regard to our American friends, since it closes the door to the slightest suspicion of partiality.

I have the honour to be, sir, your obedient servant.

(Signed) J. C. K. LAFLAMME.

QUEBEC, November 9, 1905.

NOTES ON THE RETROCESSION OF NIAGARA FALLS.

Summary.

1. Uncertainties of the geological chronicle as relating to the hollowing out of the gorge and to the retrocession on the falls of Niagara.
2. Character of the retrocession of the cataract.
3. Irregular course of the erosion at Niagara, in the past and in the future.
4. Limit of the rapid retrocession.
5. Secular oscillations of the basin of the Great Lakes and their influence on Niagara river.
6. Variations of the volume of water in the river, both on the Canadian and on the American side.
7. Influence of the electric works on the cataract.
8. Conclusion.

1. I will not undertake to give either the geological history of the Niagara river or that of the falls. The history of the past has no part in the programme assigned to me. Moreover, to estimate what Niagara has been, through bygone geological ages, is an extremely complex problem. For more than half a century many great geologists, Canadian and American, have thoroughly studied the subject. In spite of their labours, and notwithstanding all the hypotheses, born of their investigations, or perhaps owing to these very hypotheses it must be confessed that the question is far from being solved. If, in the main, the history of the falls is now fairly well known, the details are yet ungrasped. And in the present instance the details are of more importance than the general facts definitely recognized by science.

This disagreement among geologists becomes more evident when it is remembered that some of the best known assign 5,000 years as the time taken by the cataract to cut out its bed from the heights of Queenston to its present site,

while others, of equal scientific standing, assert that no less than 50,000 years were required for hollowing out Niagara's gorge. Between these extreme figures are to be found the estimates of many others, which suffices to show that upon this point of the history of Niagara, agreement is far from absolute, and to prove also how uncertain and how susceptible to different interpretations are the data upon which we have to work.

I might perhaps say as much in regard to the specific question of the retrocession of the fall. The fact is known to almost every one. But it is only since 1842 that measurements were made and that definite data were obtained.

Before that time, from Father Hennepin, in 1673, to the triangulation by James Hall, in 1842, it could be said that the Horseshoe had retreated, but to what extent no one could definitely ascertain.

As it is this retrocession of the falls which I have had more particularly to study it may be well to detail the actual process as agreed on by all geologists.

2. On the whole length of the crest of the cataract, water flows over a thick bed of dolomitic limestone.

The upper layers, much broken and furrowed, overlie other parallel strata, more compact and more resisting. The whole is what is called the Lockport or Niagara limestone. It is over the first series of these strata that the water of the river descends from the head of the rapids to the cataract.

Under this limestone, and parallel to it, lies a mass of foliated compact argillite, that constitutes almost all of the lower portion of the bank. These schistose masses are demolished both by the rebound from below and the direct attack of the falling waters from above. They crumble and disappear, so that sooner or later the limestone layers above become overhanging, when deprived of the support which upheld them, then give way under the weight of the rushing water, and in falling cause the crest of the cataract to recede. Later, the same process is repeated, bringing about each time retrocession of the crest.

It is not then, as might be thought, the friction, although enormous, of the water, which wears away the layers of the bottom and causes them little by little to disappear; it is, rather, the destruction of the support of these beds which brings about their fall in large or small quantities. The process is one of demolition rather than one of erosion or dissolution.

3. Consequently, the extent of the retrocession, its direction and its limit, all depend on data rather difficult to elucidate in detail, should there be reached a greater hardness in the argillitic lower beds; or again, should the limestone strata become more compact and more resisting, the retrocession will become slower. Reverse modifications in the physical condition of the beds would hasten it.

Differences on the resistence of the geological strata have equally to be taken into account when it is a question of forecasting the direction in which the retrocession will take place. Such direction must be largely influenced by the fact that through the vast expanse of the Horseshoe some parts will naturally give way more easily than others under the disintegrating action of the waters. Finally, it must not be forgotten that if the mass of waters be greater at one point than another, the limestone will break away sooner there than elsewhere, and the retrocession at such a point will be to the extent accelerated.

This will explain why the retreating of the Canadian falls is three or four times more rapid than that of the American; why it takes place, so to speak, by spells, now quickly, now slowly;* why again it is more pronounced at certain points of the Horseshoe than at others; and why, lastly, it happens that it is not always most marked where there is most water.

It is therefore evident that the yearly rate of retreat of the cataract is continually varying, but further inquiry may make it questionable whether the figures given are strictly accurate. It must be remembered that the exact

determination of the crest line of the Horseshoe, on which depends the estimation of the extent of the retrocession, can only be determined by a very minute triangulation based upon a certain number of fixed points on the shores and other points equally stable selected along the crest itself. Now, nothing is more unstable than a sheet of falling water. It may happen, and doubtless it does sometimes happen, that some of the points selected as guiding marks on the crest of the falls are not recognizable at the different stations or are confounded with nearby marks.

This explains certain anomalies to be found in the profiles of the Horseshoe as traced in 1842, 1875, 1886 and 1890, and reproduced by Mr. Spencer in 1894.† Unquestionably the strangest of them is to find that the profile of the Horseshoe is farther back in 1886 than in 1890, for at this particular point the fall is shown to have come forward during these years instead of receding. The same may be said about the profile of 1875 and 1886; they overlap each other on the west side of the Horseshoe.

Therefore, the problem to be solved, when measuring the retreat, is a very difficult one in its ultimate details, and only approximate figures can be reached, with little importance attaching to the fractions of a foot which the computation may give.

As a general conclusion, it may be said, without fear of contradiction, that we are not sufficiently acquainted with the intimate physical structure of the banks of limestone and shale that occasion the cataract to recede, to state positively either what is the regular rate of retreat, or that it will continue indefinitely, at the same rate, in the direction it has followed during, say, the last fifty years. At the present it seems to follow the outline of Goat island; whether it will always do so, is unknown to us.

In the opinion of Mr. J. W. Spencer, whom I had the pleasure of meeting at Niagara, and whose geological studies of this locality, carried on for many years with an untiring devotion, are of great value, the erosion will continue for a time toward Goat island, after which the western side will be affected.

A peculiar phenomenon occurs at the falls; powerful jets of water from time to time spout upwards a hundred feet above the crest of the Horseshoe; they appear to be geyser-like explosions, brought about by a sudden very powerful vertical action. Their localization is quite definite. They are only seen where the two sides of the Horseshoe are closest together. It must be remembered that the regularity of the curve that gave the name of Horseshoe to the Canadian fall is now only to be seen at its extremities. The central part more nearly resembles a fairly sharp 'V.' It is at the apex of this 'V' that the vertical spurts take place.

Many think them to be caused by air compressed behind the curtain of the cataract, which it rends from time to time in forcing an outlet. If this be so why should this compressed air not escape at each end of the curtain by following the profile of the escarpment? There is no lack of space, since one can go behind the falling mass of water. Besides when visiting the Canadian tunnel, which opens behind the enormous fall, there is no sensation of compressed air. Some would certainly exist there, although in a lesser degree than at the centre. Moreover, why should these explosions take place upwards and not perpendicularly to the falling sheet of water? I rather incline to see in them a hydraulic ram effect. The huge mass of rushing water meets jutting rocks, which it strikes with energy

*Mr. Grabau, in his Geology and Palæontology of Niagara Falls and vicinity, p. 83, gives the following figures as representing the mean retrocession of the Horseshoe as evinced by measurements made by Hall in 1842; by the engineers of the Lake Survey in 1875; by R. S. Woodward in 1886, and by M. S. Kibbe, in 1890, Niagara retreated 2·01 feet per year from 1842 to 1875, 1·86 feet from 1875 to 1886, and 5·01 feet from 1886 to 1890. Last summer Mr. Spencer proceeded, with greatest care, to make new determinations of the profile of the cataract. They will, probably, when the computations are finished, give us another figure.

†'Duration of Niagara Falls.' The American Journal of Science, Dec. 1894, p. 461.

sufficient to shoot a part of this water to a higher point than the starting level.

But whatever may be the explanation of these mighty spouts they are an evidence of extreme mechanical action, a powerful process of erosion taking place at the apex of the 'V,' and so long as the crest of the Horseshoe keeps its present profile it must be at that point that the greatest amount of erosion will take place.

The caving in of large areas on the sides of the Horseshoe may modify this state of things and prevent the point of the 'V' from eating away more ground than the rest.

4. Now, to resume the question of the falls, from which these digressions have carried us.

I have attempted, above to show the uncertainty of the computations hitherto made regarding the rate of retreat. Moreover, even assuming these figures to be accurate, there is doubt if this rate will be maintained invariably and ever constant at the mean of the last fifty years.

As the falls retreat, the thickness of the hard limestone beds increases. It will have reached its maximum when the point of the Horseshoe has arrived at the line of shoals close to the south end of Goat Island. On the other hand, the friable argillitic underpart of the profile of the escarpment decreases in thickness as the falls draw nearer Lake Erie, owing to the general dip of the layers toward the south. Dr. J. H. Clarke, New York State geologist, believes that when the cataract has reached the line of shoals above mentioned, the escarpment will be wholly composed of the limestone strata, the dip of the argillites southward having reached the lower level of the river bed. By that time the fall will have grown some fifty feet higher than it now is, and the retreat, being thereafter exclusively the result of the wear of the limestone, will become slower.

5. A factor that must seriously affect this study of Niagara is the weight of the volume of water precipitated into the chasm. If, as before stated, the volume of water varies, one of the weightiest causes of retreat must also vary in the same proportion, and all the deductions drawn from the present data will suffer should there be any difference in the flow of the Niagara river. Now, geologists tell us that the part of the surface of the American continent that includes the Great Lakes is subject to slow oscillations, which result in a general upheaval on the northeast or a sinking on the southwest. This secular crustal movement, slow, but continuous, will begin by retarding the flow of the water running northeasterly. Then a time will come when Lakes Superior, Michigan, Huron and Erie instead of draining through Lake Ontario, will send their waters toward the Mississippi through the southern extremity of Lake Michigan.

I may borrow the following figures from Mr. Grabau:* In 2,000 years the Illinois and Niagara rivers will share equally the waters of the Great Lakes. In 2,500 years the Niagara will have but an intermittent flow. In 3,000 years Niagara will be no more, and all the immense hydrographic basin of the Great Lakes, save that of Lake Ontario, will drain into the Mississippi. Therefore until then, the discharge of Niagara must continually decrease and the eating away of the falls will vary accordingly. We will see later on what is to be thought of these figures.

But before going further, are these crustal movements really so regular and constant as they are said to be? They are found in Scandinavia, in Greenland, and on a number of other coasts. It is also known, however, that they do not occur with regularity, nor do they always work in the same way.

According to Dr. Clarke,† the shore at Percé on the Gaspé coast which was going down fifty years ago is now rising. Who is not acquainted with the classic example of the famous temple of Serapis, in Italy, which, after having been for a long time buried under water, owing to the settling of the soil, emerged later on, and attained several centuries ago a level that has not varied since?

*Loc-cit., p. 65.
†Loc-cit., p. 490.

The crustal movements have every variety of period; some may be secular, some may last a few years only, and to refer specially to the movements which may be affecting Niagara river, nobody yet knows its period. It may continue, it may come to an end, or it may reverse itself. It is, therefore, impossible upon such uncertain data to make very positive assertions, the reliability of which could never go beyond that of the premises. Such was the position lately taken by Dr. Clarke.

Consequently, the possible oscillations of the basin of the Great Lakes are hardly worth taking into consideration in the study of such a problem as we have before us, unless we be willing to extend conjectures to a future, so remote as to deprive them of any interest.

6. It may be asked whether the recession of the falls will lessen the quantity of water which now flows along the Canadian shore in the upper rapids. On that score I do not believe that we have much to fear. No matter what direction the retreat may take, we shall always have more water than the Americans. The level of the river bed is lower on our side. The first sill of the upper rapids crosses the whole of the river dipping towards the Canadian shore; at this point it is considerably lower than on the American side. The Canadian fall is about ten feet lower than the American, and the water naturally bears towards our side. If the hollowing out of the Horseshoe should result in a modification of the general level of the river, there is reason to believe that we would not be the sufferers.

Moreover, it must not be forgotten that the Niagara river, where the falls now exist, turns at almost a right angle, from southeast to northwest, and that, consequently, the great mass of its water strikes the Canadian shore before taking its new course.

The American channel hardly carries the surplus. Already, in order to protect the Canadian wall from erosion, special measures have been taken.

The effect of this deviation is all the more accentuated since the bed of the river becomes much narrower at the very point where its course is changed. The flow is, so to speak, choked between Goat island and the Canadian shore. The mass increasing, has a more marked tendency, by virtue of its inertia, to continue on its first course and thereby to bear towards our side.

It therefore matters little to us whether the new Horseshoe gorge in process of formation follows the centre of the river, or, as it had done for the last half century, works its way parallel to the shore of Goat island. I do not believe that the volume of the Canadian waters will be seriously affected thereby.

The same thing cannot be said of the American channel. It will be dry before the new Horseshoe gorge has reached the line which joins the upper end of Goat island to Dufferin island.

Already, owing to tappings made at different points of the river above the falls, the general level has been so modified that nearly every spring, according to the citizens of Niagara, the ice from Lake Erie, not finding enough water to float it, runs aground at the entrance of the American channel and blocks it completely; so that the American fall for a few days ceases to exist. This phenomenon, which was exceptional before the establishment of the electric works, seems to have become an almost annual one.

7. Permit me to make the statement here, although this matter is not directly relevant to my instructions, that the danger which really threatens Niagara falls is not so much from the wearing of its bed as from the abstraction of a large proportion of its waters by the electrical companies now or likely to be established.

Already, according to Dr. Clarke,* when the five electric companies now in operation at Niagara produce to their charter limits and abstract a total of

*Loc-cit., p. 500.

48,000 cubic feet of water per second, the water level will reach the bottom of the river at the American shore. And if these abstractions are multiplied, always above the falls, the American fall will disappear finally; even the Horseshoe will lose a part of its majestic splendour.

Though, as before observed, this question, an extremely delicate one, whether considered from the standpoint of public or private interests, does not strictly enter into the scope of the present notes, I have deemed it well to place my views on it before the International commissioners, in view of the high competence, of the great influence it is in their power to exercise with the constituted authorities. I may add that the preservation of the falls in their present general state may itself become the object of an International understanding.

So grand a natural phenomenon, which every year attracts, it is said more than eight hundred thousand visitors, is surely worth considering the insurance of its perpetuity.

On this subject may be read to advantage the very interesting paper by Dr. Clarke, entitled, 'The Menace to Niagara,' published in the *Popular Science Monthly* for April last, and from which I have freely borrowed for the present report. In it the question is treated without *parti pris* and with great soundness and independent judgment.

8. Conclusion. Every year Niagara falls are receding. The process of this retrocession is such that it is impossible to formulate any precise forecast as to its future rate and direction outside of generalities, all is more or less problematic.

This phenomenon is liable to many variations, owing to possible changes in the physical consistency of the geological beds over which the water descends. 'What will be the character of the channel which is now being formed,' says Mr. Grabeau, 'can only be a matter of conjecture.

At all events, I do not think the Canadian waters are, for long years to come, apt to suffer greatly from the retreat of the falls, whatever be its direction.

During the recedence of the Horseshoe towards the upper sill of the rapids, everything leads me to believe that the Canadian side will always have its great share of the hydraulic force of the river.

Once the falls have reached the upper ledge of the rapids in many hundreds of years (1,000 years, according to Grabau), assuming that the mean rate of retreat remain constant, which is far from certain, the retreat of the cataract will enter into a phase of relative rest, and the erosion will henceforth hardly take any other form than the wearing out of the lips of the new gorge, particularly that of the Canadian side.

The American channel will have then long disappeared, and the intakes of the Canadian works, after having gradually become impoverished as the line of the fall is rectified and identified with the sill of the upper rapids, will end by being dry.

The fall will then be at the first sills of the rapids. It will be higher than the present cataract by some fifty feet, and will noticeably resemble the drawing which Father Hennepin left us of that which he saw in 1673, when the Horseshoe did not exist, and the American and the Canadian falls were on one plain. The only difference will be that the fall will then be single, Goat island having joined the American shore.

Any one desirous of knowing in how many years the falls will reach that point should study the figures of Mr. Grabau, quoted above. Perhaps it is more prudent to simply say with Dr. Clarke, that these estimates of geological chronology express interesting possibilities, but hardly rise to the dignity of probabilities.*

Mr. Grabau,† himself, after having reproduced the figures which, according to C. H. Hitchcock, G. F. Wright, Spencer, Taylor, Pohlman and Lyell, give the

*Loc-cit., p. 489. †Loc-cit., p. 85.

geological age of Niagara, very wisely concluded by the statement that such figures are hardly more than the expression of personal opinions, and that they exclusively reflect the ideas which these writers have formed as to the rapidity of the erosion caused by the river. And he adds that there may be a reverse of causes still unknown which may have contributed, in a large measure to lengthen or shorten this period. These causes, once known will probably entail the revising of all calculations and will, no doubt, lead to different results.

In continuation of this thesis, it might be said that the factors yet undiscovered will possibly considerably modify all that has already been thought and written on the retreat of the falls in particular. I believe there are few scientific problems in which the personal equation plays so great a part. This is why the present report, while being little more than a summary of the principal works on Niagara, contains such a small proportion of the figures and calculations so abundant in the numerous monographics written on the subject.

(Signed) J. C. K. LAFLAMME.

QUEBEC, November 9, 1905.

APPENDIX 'W.'

DEPARTMENT OF STATE,

WASHINGTON, January 25, 1905.

MY DEAR MR. AMBASSADOR,—With reference to your note of the 3rd inst., asking that a scheme for diverting the waters tributary to the international water boundary system by the Minnesota Canal and Power Company, of Duluth, Minnesota, be not carried out, pending the meeting of the International Water Boundary Commission, I take pleasure in informing you that I have received a letter dated the 19th instant, from the Secretary of the Interior, stating that his department had directed the Commissioner of the General Office, before whom the application of the said company is pending, to suspend further action in the case, until advised as to the results of the international boundary inquiry.

I am, etc.,

(Signed) FRANCIS B. LOOMIS.

HIS EXCELLENCY THE RIGHT HONOURABLE SIR H. M. DURAND, G.C.M.G.

APPENDIX 'X.'

EXTRACT from a Report of the Committee of the Honourable the Privy Council, approved by the Governor General on September 19, 1905.

On a report dated August 11, 1905, from the Minister of Public Works, stating that in January, 1905, Mr. Edward Wellington Backus, of Minneapolis, made an application for himself and those associated with him under chapter 92 of the Revised Statutes of Canada, for the right to construct a power dam across the Rainy river from a point in the town plot of Alberton, now the town of Fort Francis, to a point in the State of Minnesota, United States, opposite the said town of Fort Francis.

The Minister further states that with this application were also transmitted to the Department of Public Works plans showing the nature of the work to be performed, one being a sketch showing the location, and the other showing details of the mode of construction of the work.

The Minister further states that on January 19, 1905, the said E. W. Backus made with the government of the province of Ontario a certain agreement whereby the applicants obtained from the government of the said province a grant in fee of lands and power on the Canadian side of the international boundary for the purpose of developing the water-power there and utilizing storage facilities with a view of creating a large amount of power for the operation of mills and other manufacturing establishments, the consideration of such acquisition being stated in the agreement at $5,000; the agreement in question containing several conditions as regards the character and dimensions of the works; the raising and maintaining of the waters of Rainy lake; the use or non-use of flash-boards; the construction of power-houses; the expenditure of $50,000 on the works within nine months from the date of the agreement; the delivery of power to the town of Fort Francis after January 1, 1907, for municipal purposes and for public utilities; the operation and delivery of said power; the rate at which it shall be furnished; the intervention of the Lieutenant Governor in Council concerning the price of the power or energy to be created, and several other agreements of different kinds always bearing upon the delivery and price of the energy to be manufactured out of the works approved by the agreement.

That the agreement also, in clause 14 thereof, reserves and excepts all the rights of the Dominion of Canada in navigation and the improvement thereof by the construction of locks, dams, canals, and otherwise, the government of the Dominion or the province of Ontario to have the power to enter upon the premises and maintain and repair such canals, locks, dams or other works for the improvement of navigation without compensation. It is also agreed that no sawdust, chemical or other refuse of any kind shall be placed or deposited in the river, etc.

That the application so made by Mr. E. W. Backus, on behalf of the Ontario and Minnesota Power Company was referred to the Chief Engineer of the Department of Public Works for report, and that the officer in question stated that in so far as the construction of the dam is concerned, it would in no way interfere with navigation above or below the falls at Fort Francis, but would, in fact, be an improvement; that the dangerous rapids two miles above Fort Francis would be flooded, thereby improving materially the navigation; that the freshet waters stored in Rainy lake could be let out during the season of low water, thereby also considerably improving the navigation of the river between Fort Francis and Lake of the Woods; and that the only objection that could be raised to the proposed elevation of the dam is provided for by a proposed revetment wall to be constructed by the company, and also by a clause in the Act of incorporation of the Company, which makes all damages to lands caused by their works a charge to be borne by them. The Resident Engineer quotes the opinion of the Chief Engineer of the United States army, who says that the height of the dam appears to him unobjectionable, provided that the said dam is operated so as not to reduce the flow of Rainy lake during the low water season.

That in addition to the report obtained from the Engineer of the Department of Public Works the matter was referred to the Department of Justice, and that it reported that, in so far as the Dominion government was interested in the proposed works it had to consider them in so far as they affected the navigation and in so far as they affected the fishing, and also in so far as they could affect an unfinished canal and lock at the place where the dam is to be erected.

That at the session of parliament just closed, the Ontario and Minnesota Power Company have obtained an Act by which that company are authorized

to construct and operate a water-power now existing at Fort Francis and build all necessary works for that purpose, provided no work so authorized shall be commenced until plans thereof shall have been submitted to and approved by the Governor in Council. The Act in question contains several clauses referring to the production of power or electrical energy, the delivery thereof, the construction of powerhouses, etc., the settlement of the price for power by the Board of Railway Commissioners. A clause is also inserted to prevent the diversion of that energy for use in the United States without an order of the said Railway Commissioners, the board having full jurisdiction to inquire into the matter as often as necessary, and to prescribe any action on the part of the company not inconsistent with the Act passed, etc.

That on communication with them on the matter, the Department of Marine and Fisheries have sent to the Department of Public Works a plan of the fishway which they think should be erected by the company in connection with their works, the said fishway to be built subject to the inspection and approval of an officer of the Department of Marine and Fisheries.

The Minister recommends, in view of the above application of the Ontario & Minnesota Power Company; of this agreement with the government of the province of Ontario, a copy of which is hereto annexed; of the Act passed by the parliament at its last session, and of the reports made by the Chief Engineer of the Department of Public Works, and the report of the Department of Justice, that authority be given to approve of the plans submitted by the said company, subject to the following conditions, viz.:—

1st. That the company shall not, in the execution of their works, construct them in such a manner that they will in any way interfere with the navigation of the Rainy river either above or below the point where the works are to be constructed at any time during the season of navigation, and that they shall not increase the height of water either by the construction of the dam itself or by placing flash-boards upon the said dam in such a way as to reduce the natural depth of water below said dam, nor generally will they interfere in any way detrimental to the said navigation.

2nd. That at any time during the construction of the works, or after their construction or during their operation, the Minister of Public Works shall have the power, when it shall appear to him necessary after a proper examination, to regulate the retention or flow of water by or over the dam; to enter on the works for such investigation, and also to have the right to make such regulations and issue such instructions as may, to the said Minister, appear advisable and necessary in the interest of navigation.

3rd. That the permission be granted subject to the conditions inserted in the agreement between the government of the province of Ontario and the applicants, and also subject to all the conditions and reservations expressed in the Act of Parliament passed at its last session respecting the Ontario & Minnesota Power Company, Limited.

4th. That no work will be done under the permission to be given to the Company which will in any way interfere with the lock, canal or other works of public nature already executed at Fort Francis by the government of Canada nor will any bridge or any other erection or construction of any nature whatsoever on, over or across said lock, canal or other works, be built, nor generally shall any use be made thereof, except by permission in writing given to that effect by the Minister of Public Works.

5th. That no work for the construction of any dyke or retaining wall provided on the plans submitted by the company shall be commenced until the detailed plans thereof shall have been submitted and approved of by the Minister of Public Works.

6th. That should it appear necessary to the Minister of Public Works during the course of construction of the works hereunder to be authorized to

cause said works to be interrupted for any changes, alterations, etc., as to him may appear advisable, then the company will immediately cause the said works to be stopped forthwith, and will carry out any alterations or changes which may be ordered by the said Minister, and will conform in every way to the directions of the said Minister.

7th. That the company shall provide in the execution of their works for the construction of the necessary fishway upon a plan and in a manner approved by the Department of Marine and Fisheries, the officers of that department to have, for that purpose, the right of entering upon the work and seeing to the proper construction of the said fishway in accordance with whatever plans and specifications they may prepare.

The committee submit the same for approval.

(Signed) JOHN J. McGEE,

Clerk of the Privy Council.

APPENDIX 'Y.'

EXTRACT from a report of the Committee of the Honourable the Privy Council, approved by the Governor General on November 21, 1905.

The committee, on the recommendation of the Minister of Public Works, advise that in view of the appointment of Mr. J. P. Mabee as one of the Justices of the High Court of Ontario, Mr. George C. Gibbons, K.C., be in his place appointed chairman of the Canadian section of the International Waterways Commission.

(Signed) JOHN J. McGEE,

Clerk of the Privy Council.

APPENDIX 'Z.'

DETAIL REPORT OF THE SUB-COMMITTEE WHICH MADE INSPECTION OF THE GREAT LAKES SYSTEM FROM DETROIT TO DULUTH.

Index of Matters contained in this Report.

1. The River St. Clair.
2. The St. Clair flats canal and Lake St. Clair.
3. Lake Huron.
4. St. Marys River.
5. The works of the Michigan Lake Superior Power Company.
6. The new West Neebish channel.
7. The works of the Chandler-Dunbar Water-Power Company and the Edison Sault Electric Company.
8. The revocable licenses granted by the United States War Department to the Chandler-Dunbar Water-Power Company.

9. The works of the Consolidated Lake Superior Power Company operating on the Canadian side.
10. The Canadian ship canal.
11. The United States ship canal.
12. St. Marys river west of the ship canal, and White Fish bay.
13. Lake Superior.
14. The harbours of Port Arthur and Fort William.
15. The water-power of Kakabeca falls.
16. The harbour of Duluth.
17. The proposed works of the Minnesota Canal and Power Company.
18. The works of the Ontario and Minnesota Power Company at Koochiching falls.
19. The harbour of Chicago and the Chicago drainage canal.
20. Lake Michigan.
21. The Detroit river and Lime Kiln crossing.

A committee, composed of Mr. James P. Mabee, chairman of the Canadian section, Mr. George Clinton, member of the American section, and the writer, Secretary of the Canadian section, proceeded to Sault Ste. Marie, on August 12, 1905, to investigate and report upon the uses of the waters of St. Marys river, as set forth in the Act of Congress, approved on April 13, 1902. In section 1, page 35, the duties of the International Waterways Commission, in regard to the matters at the Soo, are described as follows:—

'Subject to the express precedent conditions hereinafter mentioned, the Michigan Lake Superior Power Company, of Sault Ste. Marie, Michigan, its successors and assigns, after first obtaining consent of the Secretary of War and the Chief of Engineers, and their approval of the said canal and remedial works proposed, is hereby authorized to divert water from the St. Marys river into its water-power canal now being constructed at Sault Ste. Marie, Michigan, for water-power purposes, while and so long as such works and diversion of water from said river shall not injuriously affect navigation therein, nor impair or diminish the water levels or any natural increase thereof, either in Lake Superior or in the United States ship canals and locks or the navigable channels, locks, or ship canals connected therewith, whether natural or artificial, now existing or which may hereafter be established or created by the United States for navigation purposes; and conditioned further, that the said company shall establish, maintain and operate suitable and sufficient remedial and controlling works in the rapids of said river, to the approval of the Secretary of War and the Chief of Engineers; and said company shall maintain and operate said canal and works in accordance with any rules and regulations that may hereafter be recommended by any international commission and that shall become operative. Whenever, in the judgment of the Secretary of War, the operation of said canal and remedial and controlling works, or either of them, either in themselves or in conjunction with any other canal or canals in the United States or Canada which now, or hereafter may, exist, is injuriously affecting water levels or the navigation of Lake Superior, the River St. Marys, or other channels, locks or ship canals connected therewith as hereinbefore provided, he shall impose upon said company such rules and regulations for the operation of said canal and remedial works, as may, in his opinion, be necessary to prevent such injury. It shall become his duty, and he shall have the authority to enter upon the property of said company and to close said canal in whole or in part to the extent necessary to maintain water levels and to require said company, at its own expense, to remove, add to or modify said works or any part thereof to the extent necessary to maintain water levels. Neither the Secretary of War nor the Chief of Engineers or any officer or other person acting under direction of them, or either of them, shall be in any way liable by reason of anything done in the execution of this provision.

'All remedies herein provided, however, shall be cumulative, and shall be without prejudice to any other remedies either of the United States or of individuals for failure of the said company to maintain said levels for navigation purposes, as herein provided.

'Nothing herein contained shall be held to affect any existing riparian or other rights of any person or corporation, or the existing remedies therefor, or any action at law or equity now pending. The right is hereby expressly reserved to Congress to alter, amend or repeal the provisions contained in this paragraph.'

Mr. George Clinton went by way of Owen Sound, taking the Canadian Pacific Railway Company's steamer *Alberta*, and arrived at Sault Ste. Marie, Michigan, on Sunday, August 13.

Mr. James P. Mabee and the writer proceeded to Port Huron, Michigan, to investigate the conditions and the uses of the waters of St. Clair river and Lake St. Clair. The start was made from Port Huron, Michigan, the visitors proceeding east.

1. THE RIVER ST. CLAIR.

The St. Clair river has two different sections—the upper or undivided channel, and the lower portion. The undivided channel runs from Lake Huron to the head of Chenal Ecarte, a distance by steamer track of about 27 miles. At this point the river begins to divide into a number of channels. The one used by vessels is called the 'South Channel,' and its length, from the head of Chenal Ecarte to the southwest end of St. Clair Flats canal, is about 13 miles, making the total length of the steamboat track, from Lake Huron to Lake St. Clair, about 40 miles.

The discharge through the upper or undivided portion of the river is 206,400 cubic feet per second, when Lake Huron is at a stage of 581·40 feet above mean tide at New York. The increase of discharge per foot rise of the Lake is approximately, according to the engineers of the United States Army, 19,238 cubic feet per second. The river leaves Lake Huron with a velocity, opposite Fort Gratiot, of about 5 miles an hour, and enters Lake St. Clair, through the canal, with a velocity of about 1¼ miles an hour. At intermediate points the velocity varies irregularly between these limits. The banks of the river are clay and sand and usually quite steep; there are no rocks. There are two islands in the upper portion of the river : Stag island and Woodtick island.

Extensive dredging works have been performed by the Canadian Department of Public Works at Sarnia, in front of the Grand Trunk Railway wharf and the Lake Erie ferry slip. This has been done, as Sarnia is one of the principal harbours of the Grand Trunk Railway system and a stopping place for all Canadian passenger steamers passing through the St. Clair river. From the foot of George street, 3½ to 5 fathoms can be carried close to the shore in front of and below the Grand Trunk depot and continuing down to Fromefield. A bay with shallow water extends from the foot of George street up to Point Edward. The anchorage at the head of St. Clair river below the rapids and abreast of Port Huron and Sarnia is good in clay and gravel. In the rapids and abreast of Point Edward it is rocky and bad. Good holding ground and some clay are to be found on the Canadian shore below the Grand Trunk elevator. Vessels generally anchor as close to each shore as safety permits, to leave the mid-channel clear for passing vessels. Fixed red range lights at Point Edward lead into the head of the St. Clair river from Lake Huron. The front light is on the beach 107 feet back from the water edge, and is visible eight miles from all points of approach by water. The rear light is 579 feet south of the front light and visible 9¼ miles in the line of range. This range is followed by vessels until intersected by the Fort Gratiot range, on the United States side of the river.

The Port Huron rapids are about two miles above the town of the same name. The velocity of the current at this point is about 5 miles per hour. Two range lights on the American side, one mile below Fort Gratiot Light, mark the sailing line through these rapids. There is good holding ground in clay or gravel bottom between Port Huron and Sarnia. The shoal at the mouth of Black river is marked by two buoys, a gas buoy about midway between the mouth of the river and the Canadian side, and a black spar buoy about 2,000 feet below the gas buoy. Between these buoys and the Canadian side there is a channel with a minimum width of 1,000 feet, and a depth of 21 feet at a stage of 581·5 feet above mean tide at New York. Between the buoys and the American side there is a depth of 14·5 feet at the above stage. This shoal is not quite stable, but is, on the contrary, increasing at a slow rate. It will be perceptible in two or three years. The channel in Black river has a depth of 15 feet up to the Grand Trunk Railway bridge. At Stag island, the American channel has a depth of 21 feet, at a stage of 577·5 feet above mean tide at New York, and a minimum width of 900 feet. The Canadian channel has a minimum width of 550 feet and a depth of 28 feet at the above stage. A crib marks the lower entrance, and two range lights mark the upper entrance to this channel. At Corunna, opposite Stag island channel the Canadian channel is in the best order. There are range lights to guide through good water past the shoals at the head of Stag island, and also past the shoals at the mouth of Talford creek, which coming from the Indian reservation, in the county of Lambton, Ontario, flows through Fromefield into the river, right opposite Marysville, Michigan.

Mooretown and Courtright, Ontario, which are just 1½ miles apart, were visited. The Lake Erie and Detroit River railroad runs through the village of Mooretown. There are two wharfs with about 16 feet of water. Baby's creek enters St. Clair river about one-third mile below the village. At Courtright, opposite the town of St. Clair, Michigan, there is good water along the wharfs with depths of 15 to 20 feet. At St. Clair, Michigan, the American channel has a minimum width of 800 feet and a depth of 21 feet at a stage of 577·0 feet above mean tide at New York. The Canadian channel has a depth of 26 feet at the above stage, with minimum width of about 800 feet. Pine river empties into St. Clair river at St. Clair, Michigan. The original depth of that river over the bars was 5 to 8 feet. In 1897 the channel from the mouth of the river to the shipyard was dredged to a depth of 14 feet, and in 1899 further dredging was done from the shipyard to Belknap's brickyard to a depth of 12 feet. The present available depth in these two channels is 13 and 11 feet respectively. The shoal or middle ground between the American and Canadian channels, between St. Clair, Michigan, and Courtright, Ontario, is marked by two gas buoys, one at the upper and one at the lower end.

At Sombra, Ontario, opposite Marine City, Michigan, there are two wharfs, one-third mile apart, extending about 200 yards in shallow water to 13 feet at the outer ends. At this particular point the channel on the American side is straighter and wider and therefore, more frequently used than the Canadian channel.

At Marine City, Michigan, the United States government had dredged in 1897, at the mouth of the river to the first bridge, a channel 75 feet wide and 15 feet deep. In 1899 the channel was dredged to Broadway bridge, to a width of 75 feet and a depth of 14 feet.

The vessel route at the mouth of St. Clair river is through the boundary line channel. The United States government at this point has expended large sums of money in improving the channel by driving piles and dredging between them. The greater portion of the improvements were made on the United States side of the line; but some of them were also made in Canadian waters, and inasmuch as the improved channel has completely obliterated the natural one, it follows that the improved channel, regardless of its alignment, is and has

always been considered a common channel to Canada and to the United States. From the St. Clair flats to Lake Huron the route follows the boundary line except when passing Woodtick island and Stag island, where it is in United States waters, yet there is also a good channel in Canadian waters past the islands just named.

A short distance from Marine City, Michigan, and Sombra, Ontario, is Woodtick island, and a little farther east the village of Port Lambton, Ontario.

Past the Chenal Ecarte there is the village of Algonac, Michigan, opposite Russel island, at the head of the north channel. This north channel, opposite Pointe aux Trembles, Michigan, divides into two sections, one flowing through Chenal à Bout Rond into Goose bay, the other flowing into Anchor bay.

Opposite Grand Point, on Herson island, in the south channel, the wreck of the steamship *Minnesota* which was burnt and sunk in October, 1903, close to Squirrel island, has been removed during the latter part of 1904, and in 1905 it was ascertained that there is at this particular site a depth of 25 feet of water.

Between Walpole island and Squirrel island there is the Canadian Blind channel, which is used only by local and small craft, the average depth of water in the channel not exceeding eight or nine feet.

On the left side of Squirrel island there is also the Basset channel, which is scarcely used except by small vessels.

Between Herson island and Dickenson's island lies the middle channel, which flows from the north channel into the Big Muscamoot bay.

2. THE ST. CLAIR FLATS CANAL AND LAKE ST. CLAIR.

It will, therefore, be seen that originally the St. Clair river emptied into Lake St. Clair through several principal mouths or passes, the channels originally used being the north channel, the middle and the south passes. While each of these mouths or passes, constituting the delta known as the St. Clair flats, afforded good water, especially the north, middle and south passes, yet all were obstructed by sandy deposits forming bars in the lake.

The improvement of a channel through these flats has been the subject of discussion ever since the upper lake region had any commerce to speak of. A survey of the locality was made as early as 1841, and in 1852 the United States Congress made an appropriation of $20,000 for plans and examinations, having in view the improvement of the south pass. But it was only in 1855 that the work of improving the navigation of the St. Clair river at the 'Flats' was actually commenced under the direction of the Buffalo Board of Trade. The funds were obtained by subscriptions from the United States lake ports interested in the lake trade. The project was to dredge a channel 60 feet wide and 12-feet deep in the middle channel of the south pass, 1½ miles west of the boundary line route now in use.

In 1857, under a United States appropriation of $50,000, the improvement was continued on the same line, and in 1858, the Canadian government contributed towards the still further improvement on the same line, which sum was expended under the direction of the Buffalo Board of Trade, under arrangements approved by the Canadian government. One of the conditions was that the money would not be spent until a channel of 125 feet wide and 12 feet deep had been first excavated by the United States, which was done. This channel was found to be difficult to maintain and navigate. The present St. Clair Flats canal was projected in 1866 by Colonel Cram, of the United States Army Corps of Engineers.

The first plan provided for a straight channel, 13 feet deep and 30 feet wide, across the Flats east of the mouth of the old channel. This was completed in 1871. The canal was protected on either side by a dike 7,227 feet

long, making an aggregate of 14,452 feet of timber cribs resting upon piles driven into the original bottom of the shoal. A lighthouse was installed at each end of the eastern pier.

In 1873 the channel was deepened to 16 feet by dredging for a width of 100 feet on either side of the axis of the canal, or a width of 200 feet in all. This was done on account of the fact that the single row of sheet piles intended by the project of Colonel Cram, in 1866, for a depth of 13 feet, had not sufficient penetration to admit dredging to 16 feet for the full width of the canal.

In 1886, another plan of improving the channel was adopted. It consisted in driving a double row of sheet piling to a depth of 26 feet along the channel face of each dike, dredging the area between the dikes to a depth of 20 feet. The channel above and below the canal was to be dredged to the same depth in the river and in the lake. But, subsequently, it was considered sufficient to obtain a depth of 18 feet. This work was completed in June, 1892. The pile revetment along the channel face of each dike was then finished, and a channel of 18 feet deep from about 900 feet above the canal in St. Clair river to about 3,300 feet below the canal was available. This depth of 18 feet was obtained for the full width of the canal, viz.: 300 feet or more for its full length. At the lower end of the canal, the 18 feet deep channel gradually widened to a width of 380 feet, at a distance of 300 feet below the canal. From that point to a farther distance of 3,300 feet below the canal, the channel had a uniform width of 380 feet.

In 1891, the late Colonel O. E. Poe, of the Corps of Engineers of the United States Army, submitted an estimate for a channel of 20 feet deep, extending from a point about 1,500 feet above the canal, then through the canal and thence to about 10,000 feet into Lake St. Clair, with a width of 600 feet at its lower end. This plan was adopted and embodied in an Act of Congress of July 13, 1892.

The work was commenced in April, 1893, and completed in December, 1894, at a cost of $107,024. At the time, the dikes of St. Clair Flats canal were 7,221 feet long each, and the channel faces were riveted with double rows of sheet piling 26 feet deep, and the backs of the dikes were protected against the action of the waves by shorter sheeting. The canal had a clear width of 295 feet between the dikes, and a depth of 20 feet. The channel had also a depth of 20 feet from deep water in St. Clair river to deep water in Lake St. Clair, with a width above the canal of 650 feet, thence gradually narrowing to the canal; thence having the full width of the canal over its entire length; thence gradually widening to a width of 800 feet at deep water in Lake Erie.

The cost of the improvement of the St. Clair Flats canal, from the beginning in 1852 to 1896, is $809,859.06, divided as follows:—

Cost of North Channel of South Pass, 1852 to 1858...	$ 64,829 01
Cost of South Channel of South Pass, 1858 to 1895, for completing project of 1868, channel 13 feet deep, single sheet piling.....	461,090 01
For completing project of 1892, including repairs to July 1, 1881.....	115,933 53
For completing project of 1886, channel 18 feet deep, second row sheet piling.....	168,007 51
Total cost...	$ 809,859 06

In 1902, the United States Congress authorized the construction of a second channel, similar to the one already in use and parallel to it, but separated therefrom by a dike of about 100 feet wide, so as to provide a channel of 20 feet minimum depth and about 300 feet wide, from Lake St. Clair up into St. Clair river for ascending boats, and a similar channel for descending vessels.

The work was started in 1904 and was in way of being completed during the summer of 1905. The appropriation made by the United States Congress for this improvement is $330,000, making total appropriation for the St. Clair Flats canal, from 1866 to 1903, $1,094,810. With the amounts spent in 1852 and 1856, by the United States and the Canadian governments, it makes a total expenditure of $1,149,810, incurred in this undertaking.

The St. Clair Flats ship canals, en resumé, comprise the dikes, the water between the dikes, and the improved channels of approach, both above and below the dikes. The improved approach above the dikes is 800 feet long; that below the dikes 11,000 feet long, and the dikes themselves are 7,221 feet long, making the total length of canal of about 19,000 feet.

The canal is marked by two lighthouses and two gas buoys. The lighthouses show the range of both the upper and lower approaches. The gas buoys are about one mile below the dikes and mark the east and west sides of the lower approach.

The width between the dikes and the width of the upper approach is 292 feet. The width of the lower approach is 400 feet. The depth at a stage of 575·0 feet above mean tide at New York is 24 feet. During the lowest water of the season of 1904, a draught of 19 feet could be carried through this channel.

Some years ago there was a dispute as to whether the St. Clair Flats canal was in Canadian waters or in the waters under the jurisdiction of the United States government. Investigation and reports were made on this subject by the Corps of Engineers of the United States Army, and by engineers engaged by the Canadian government. The reports did not agree and the question of the location of the boundary line at this particular spot is not yet finally settled. But there is no doubt that part of the St. Clair Flats canal is in Canadian territory, and that this improved water communication now in general use across the St. Clair Flats, is more or less on the boundary line between Canada and the United States. As such, this water communication is common to the trade of the lakes of both countries. Article XXVII. of the Treaty of Washington, 1871, states that the 'subjects of Her Britannic Majesty shall enjoy the use of the St. Clair Flats canal on terms of equality with the inhabitants of the United States.'

From the southwest end of the St. Clair Flats canal to Windmill Point lighthouse in Detroit river, the steamer track has a length of 17 miles. The area of the water surface of Lake St. Clair is 4,450 square miles. According to the United States Weather Bureau, the average annual rainfall in Lake St. Clair is 36 inches. The average date of opening of navigation at St. Clair Flats lighthouse is April 4, and the average date of closing of navigation at the same place is December 15.

After a short visit to Detroit and Windsor, the members of the sub-committee returned to Port Huron by the Detroit river and Port Huron Electric railway.

3. LAKE HURON.

The members of the sub-committee left Monday afternoon, August 14, on the steamship *Monarch*, of the Northwestern Navigation Company, for Sault Ste. Marie, crossing Lake Huron from Sarnia to Detour in little less than twenty-two hours. The distance between Point Edward, Ontario, opposite Fort Gratiot, Michigan, to Detour passage is 220 miles. The steamer track from Fort Gratiot, Michigan, to the Straits of Mackinac, is 243 miles. From Point Harris to Drummond island, in a right line, the distance is 206 miles. The maximum depth recorded is 750 feet. Lake Huron has an area of water surface of 23,200 square miles. Its drained area is 52,100 square miles, making a total area of its basin of 75,300 square miles. The average annual rainfall

in Lake Huron is 32 inches. Its mean surface above mean tide at New York city, during 45 years, from 1860 to 1904, is 581·40 feet. The standard high water, established in 1838, above the mean tide at New York city, is 584·69 feet, and the standard low water above mean tide at New York city, said standard being adopted for new charts, is 578.51 feet. The mean surface of Lake Huron below the mean surface of Lake Superior is 20.89 feet, and its mean surface above mean surface of Lake Erie is 8·79 feet, the discharge of St. Clair river at the mean stage of Lake Huron (581·40 feet) is 206,400 cubic feet per second. The increase in discharge per foot rise of the lake is 19,238 cubic feet per second. The average date of opening of navigation at Sarnia, or Point Edward, is April 6, and the average date of closing of navigation at the same point is December 19.

Around Lake Huron on the Canadian side, there are storm-warning stations at the following places: Amherstburg, Bayfield, Collingwood, Depot Harbour, Goderich, Kincardine, Midland, Owen Sound, Parry Sound, Presqu'Isle, Sarnia, Saugeen and Tobermory. There are also life-saving stations at Collingwood and Goderich. On the American shore we find life-saving stations at Bois Blanc island, Grindstone City, Hammond Bay, Lakeview Beach, Middle island, Ottawa Point, Pointe aux Barques, Sand Beach, Sturgeon Point, Tawas Point and Thunder Bay island.

The United States Weather Bureau has established storm-warning display stations at the following places, on the American coast of Lake Huron: Alpena, Bay City, Cheboygan, Detour (at the outlet of St. Marys river), Detroit, East Tawas, Harbour Beach, Lakeview Beach, Mackinac island, Mackinaw, Middle island, Oscoda, Ottawa Point, Pointe aux Barques, Port Huron, Presqu'Isle. Tawas Point and Thunder Bay island.

4. ST. MARYS RIVER.

The vessels enter St. Marys river from Lake Huron, at Detour passage at a point 1½ miles from the lighthouse of Point Detour. They thence proceed north in a straight line for a distance of three-quarters of a mile up to Frying Pan lighthouse. At this point they turn a little to the left and proceed again in a straight line for a distance of 1½ miles to Pipe Island lighthouse, which is situated at the southeastern end of Potagannissing bay, where they turn farther to the left. From Sweet's point the vessels again turn a little farther to the left and proceed in a straight line for a distance of 2 7-8 miles to Sweet's Point light. Off Sweet's island, from Sweet's Point light, they proceed for a distance of 4 1-2 miles, passing at a short distance off Lime island up to a point opposite Raber Point, Michigan, thence turning straight north and passing to the right of Round island, opposite Hay Point, Ontario, and Pointe aux Frenes, Michigan, covering a distance of 4 miles.

From Hay Point the vessels enter the Mud Lake channel. After a distance of 6 3-4 miles they reach the Mud Lake beacon, opposite Winter point, on the east end of Neebish island, thence for a distance of 4 miles they proceed north, up to the Sailors' Encampment channel, thence they reach Little Mud Lake channel, the Middle Neebish channel and the Hay Lake channel, passing to the left of Middle Hay Lake front light, and to the right of Frechette point, thence through the Little Rapids channel up to the Soo.

Navigation around the rapids of Sault Ste. Marie is provided for by two canals; one on the United States side and one on the Canadian side. Between the canal and the lighthouse at the entrance of Hay Lake channel, the United States government, during the season of 1905, has removed the Bayfield and other adjacent shoals to the extent of securing a channel of 21 feet deep and 1,500 feet wide. At the head of Sugar island, about two miles below the canal locks at Sault Ste. Marie, the channel divides in two. The old line of travel

known as the Lake George route, passes to the northward and eastward of Sugar island through Lake George and East Neebish. The new line, known as the Hay route, passes to the west of Sugar island through Hay lake and Middle Neebish. The two routes reunite at the head of Little Mud lake. The distance from Point Iroquois to Detour by the Hay Lake route is 64 miles, and by the Lake George route 75 miles. The least width of the channel by way of Hay lake is 300 feet, limited to a total distance of 8 miles. The general width of the channel is 600 feet or more, and the least depth at the present prevailing stage of water is about 19 feet. The least width of the channel by way of Lake George is 150 feet, and the least depth about 15 feet. Both channels are well defined by numerous buoys and by the mid-channel ranges.

There is another important channel known as the St. Joseph channel, with least depth of 13 feet, which leaves the Lake George and Hay Lake channel near their junction at the south end of Sugar island, and passing to the northward and eastward of St. Joseph island, leads into Manitoulin bay or north channel, thence to Georgian bay by way of Clappertown Main passage and Little Current, or directly into Lake Huron through channels on the east and west sides of Cockburn island, called, respectively, the Nississagi strait and False Detour channel. These channels are all in Canadian waters.

From Detour passage to Sault Ste. Marie, parts of Lake George channel from Little Rapids to the foot of Sugar island are in Canadian waters. The upper part of the channel in Little Mud lake and east channel at Sailors' Encampment, and part of the angle of the west channel, are also in Canadian waters. The United States engineers in charge of the Public Works Department of the War Office at Sault Ste. Marie, claim that the above improvements were made with the tacit consent of the Canadian government. Lake George channel was made from 1869 to 1882. Little Mud lake was dredged from 1892 to 1894 at a cost of $23,000. Sailors' Encampment channel was commenced in 1882 and finished in 1895 at a cost of $23,000. Further improvements in that channel were made from 1903 to 1905, at a cost of $11,000. Further improvements at the head of Sailors' Encampment were being made by the removal of boulders, sand and rock, from an area of 1,400 feet long and 200 feet wide on the west side of the channel just above Johnson's point, and on the east side of the channel by the removal of sunken cribs and boulder ridges covering an area of 1,800 square yards. This important work has been proceeded with during the whole summer. At the foot of Little Mud lake the angle in the channel was widened last year on the east side by the removal of 49,033 cubic yards of sand and boulders from an area of about 15,700 square yards, and on the west by the removal of 3,941 cubic yards from an area of 2,400 square yards.

The improvement of Hay lake and Neebish channel was commenced in 1893 and opened to navigation in 1894. The result was a new line of travel through St. Marys river, 11 miles shorter and 4 feet deeper than that previously available, and one which can be navigated at night with a reasonable degree of safety. In 1902 a project was adopted providing for a channel of 21 feet available depth at low water and 1,000 feet width from St. Marys Fall canal to the foot of Hay lake, thence deepening to 21 feet the present 300 foot channel to Mud lake, via Middle Neebish, and opening a new 300 foot channel to Mud lake, via West Neebish, thus providing separate channels through this stretch for up and down bound boats.

In 1904, the United States government, in Hay lake channel, spent $2,738,-081.39, and during the present season of navigation a further expenditure $1,221,033.61 was incurred. Below the islands, at Little rapids, the channel has been improved for a distance of 10,200 feet by widening on the east side 150 feet to a depth of 21 feet. The channel through the Little rapids section of the upper entrance to Hay lake is, therefore, at present 600 feet wide. The deepening to 21 feet through Little rapids was completed in 1904, from the head of the islands

to Frechette point. The deepening from Frechette point to Six Mile point was in progress during the summer of 1905.

The deepening of Nine Mile point shoal to 22 feet was commenced in 1904 and was finished in August, 1905.

A very large boulder shoal with at least a depth of 12 feet over it, called Crab Island shoal, lies in 23 feet of water near the western end of the shoal, about half a mile southwest of Barbed point and about 1,000 feet east of the usual course of vessels through Detour passage. There are a number of boulders in the vicinity with less than 20 feet over them. A red spar buoy marks the most westerly boulders of Crab island. A derrick-boat and diving outfit have been employed during midsummer of 1905 in removing the boulders from the west end of this shoal.

The sub-committee arrived at Sault Ste. Marie, Ontario, on Tuesday afternoon August 15. They were met at the Canadian government dock by Mr. Lochlan P. Morrison, junior assistant engineer of the River Improvements office, who, in the absence of Lieut.-Col. Chas. E. L. B. Davis, of the Corps of Engineers of the United States army, in charge of the district, had been directed to receive the committee officially. The members of the committee immediately embarked on the United States government steamer *Alfred Noble*, and crossing the river they proceeded at once to visit the power canal and the plants of the Michigan Lake Superior Power Company, being accompanied by Mr. Louis H. Davis, Chief Engineer of the Consolidated Lake Superior Power Company.

5. THE MICHIGAN LAKE SUPERIOR POWER COMPANY.

Was incorporated in virtue of the Act No. 39 of the Public Acts of the State of Michigan, 1883. This Act, with the amendments thereto, is the legal authority for the Michigan Lake Superior Power Company to do business in the state of Michigan. The congress of the United States in 1902, by an Act approved on June 13, making appropriation for the construction, repairs and preservation of certain public works on rivers and harbours and for other purposes, authorized the Michigan Lake Superior Power Company to build its canal on the American isde, and after the approval of this Act, the United States War Department granted the company the following permit:—

'Whereas, by the River and Harbour Act, approved June 13, 1902, it is provided (32 Stats., 361) that, subject to the conditions therein mentioned:

'The Michigan Lake Superior Power Company of Sault Ste. Marie, Michigan, its successors and assigns, after first obtaining consent of the Secretary of War and the Chief of Engineers, and their approval of said canal and remedial works proposed, is hereby authorized to divert water from the St. Marys river into its water-power canal, now being constructed at Sault Ste. Marie, Michigan for water-power purposes, while and so long as said works do not affect navigation thereon, nor impair or diminish the water levels or any natural increase thereof, either in Lake Superior or in the United States ship canal and locks, or the navigation channels, locks, or ship canals connected therewith, whether natural or artificial, now existing or which may hereafter be established or created by the United States for navigation purposes:

'And whereas, the said Michigan Lake Superior Power Company has submitted for approval of the Secretary of War and Chief of Engineers plans of its water-power canal and remedial works for the diversion of the water from the St. Marys river authorized by said Act, and has applied for consent of the Secretary of War and Chief of Engineers to such diversions:

'And whereas, the Chief of Engineers has approved the said plans, and has given his consent to such diversion, subject to the acceptance by said company of the conditions hereinafter specified:

'Now, therefore, this is to certify that the Secretary of War hereby approves the said plans, which are hereto attached, and hereby gives his consent to the diversion of water from the St. Marys river, as authorized by said Act, subject to the acceptance by said company on the following conditions:

'1. That the regulating works, including escape valves at power-house, controlling works, and remedial works, shall be operated under the inspection of the officer in charge of the St. Marys Falls canal, who shall have access to them at all times.

'2. That when the mean level of Lake Superior at the canal for any calendar month falls below 601·5 feet above mean tide at New York, according to the levels of the United States Survey Office, the flow through the canal shall be reduced, the amount of reduction increasing as the monthly mean level falls until it reaches 601·0, when all flow shall be stopped until the monthly level again exceeds 601·0, all without claims against the United States, or against any officer thereof.

'3. That in addition to the requirements of condition 2 (*supra*), all flow shall likewise be stopped, without claim against the United States, or against any officer thereof, should the monthly mean level of the lake remain below 601·5 for a period of six consecutive calendar months, and shall not be resumed until the monthly mean level shall exceed 601·5.

'4. That when the monthly mean level raises above 603·0, the flow through the canal and the remedial works shall be increased to their maximum capacity, and shall so continue until the monthly mean level shall be less than 603·0 without claim against the United States, or against any officer thereof.

'5. That should the monthly mean level of the lake remain above 603·0 for a period of six consecutive calendar months, said company shall alter its works at its own expense as soon as practicable, so as to allow more flow.

'6. That the United States shall have the right to assume entire control of the flow of the water through the canal and remedial works in cases of accidents or emergencies temporarily affecting navigation through the United States ship canal.

'7. That should cross currents, detrimental to navigation, be created by the intake or by the outflow of the canal, said company shall construct such booms, training walls, or other works, as may be necessary to remedy the evil.

'8. That said company, in its arrangement and construction of remedial works, shall leave a suitable channel and water flow for the passage of logs over and through St. Marys falls.

'9. That these limitations are in addition to the special limitations of the Act of June 13, 1905, regarding riparian or other rights of any person or corporation and the remedies therefor.

'10. That the elevations above mean tide at New York, above specified, are those established and in use at this date by the Office of the Survey of the Northern and Northwestern Lakes, commonly known as the Lake Survey Office at Detroit, Michigan.

'11. Finally, the object of the foregoing paragraphs being to hold the waters of the lake and river under the absolute control of the United States in the interest of navigation, it is expressly understood that said company shall not be entitled to damages should the government at any time or for any cause exercise its right to control and suspend the flow of water through the power canal, in the interest of navigation.

'Witness my hand, this 12th day of December, 1092.

'(Signed) ELIHU ROOT,

'*Secretary of War*

'This instrument is also executed by the Michigan Lake Superior Power Company by Francis H. Clergue, its president, thereunto lawfully authorized, this ninth day of December, 1902, in testimony of the acceptance by said company of the foregoing conditions.

'THE MICHIGAN LAKE SUPERIOR POWER COMPANY,

'By Francis H. Clergue,

'*President.*

'Attest:

'H. Von Schon,
'F. T. Trempe,

'(Seal)

'Office, Chief of Engineers, December 2, 1902.

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'War Department.'

The plant of the Michigan Lake Superior Power Company has been designed to develop a portion of the power of the St. Marys rapids.

To accomplish this end, water is diverted from the St. Marys river above the rapids into a canal running through the city of Sault Ste. Marie to a power-house situated near the shore of St. Marys river, about 4,400 feet below the rapids, and is there returned to the river, after passing through turbines, which, together with electric generators, convert the hydraulic power into mechanical and electrical power. The plant is designed to develop about 45,000 horse-power at the turbine shafts, equivalent to about 42,000 electric horse-power at the switchboard in the power-house. Of this portion about 8,000 electric horse-power is now being utilized by the Union Carbide Company and Tran-Sault Ste. Marie Traction Company.

The plant consists of the canal, head gates, power-house and power-house equipment.

The canal consists of the intake, canal proper, fore-bay and tail-race. Its total length from the harbour line above the rapids to harbour line below the rapids is about 12,000 feet.

The head of the intake is located along the established United States harbour line, immediately west of the entrance to the United States ship canal, and its width along the harbour line is 990 feet, and its depth is 18 feet, so that the velocity of the water at the entrance will be, when the canal is operating at its full capacity, about 1 2-3 cubic feet per second. The intake as it continues easterly, gradually narrows to a width of 204 feet, and deepens to a depth of 23 feet, below mean still water level at a point about 1,500 feet from the centre line of the entrance, thence continues at the width given for a distance of about 900 feet to the head-gates. The sides of the intake are retained by rock-filled timber cribs with slopes of riprap paving above the water line.

The canal proper begins at the head-gates, and for about 2,700 feet was excavated largely through sandstone bedrock to a width of about 200 feet, with substantially vertical walls. Where not excavated in rock the earth is retained by masonry retaining walls. Continuing east from the rock section, the canal extends for about 3,000 feet with rock bottom and timber-lined sides, and thence for another 3,000 feet through clay and sand, the bottom and sides both being

timber-lined below the water line. The slopes above the water line are paved with riprap. At the end of the clay section, the canal widens into a fore-bay, which delivers the water to the turbine chambers or penstocks in the power-house. The water after passing through the turbines into the tail pits, flows into the tail-race, the width of which is the full length of the power-house, 1,340 feet, and thence is discharged into the river with a velocity of less than 1½ feet per second.

In the fore-bay are located steel racks which collect floating wood, ice and other objects, and these divert such material through a wooden channel into a spillway, passing through the power-house to the tail-race.

The power-house is 1,340 feet long by 80 feet wide. Its foundation is a grillage of timber filled with concrete, resting on piles driven to bed rock. The substructure is divided by concrete walls into 81 tail pits, each one of 80 of which receives water from a turbine chamber or penstock immediately above it. The upstream ends of these tail pits are closed by segmental concrete arches and the roofs of the tail pits are monolithic concrete arches, which form the penstock and dynamo room floors. The superstructure has stone and concrete masonry walls with floors of steel and concrete, supported by steel columns, and is covered by a steel roof. The fore-bay side consists of 80 penstocks and one spilling way opening. These penstocks contain the turbines. They are 16 1-3 feet, centre to centre, 15 feet in width clear, and are closed on the down-stream side by semi-cylindrical steel bulkheads, attached to steel and concrete partition walls. The penstocks take up about one-half of the first floor space. The first floor of the river side of the power-house, which is just north of the penstocks, forms the dynamo room. The second and third floors in the power-house are arranged for the location of machinery for manufacturing plants which now use, or may use, power generated by the plant.

At the west end of the power-house is located a boiler plant of about 250 horse-power capacity with centrifugal pumps for pumping, in the event of necessary repairs to the canal or power-house, from the canal such water as will not drain by gravity into the tail-race.

The equipment of the power-house will be 80 penstock units, each consisting of two pairs of 33-inch horizontal turbines mounted on one shaft, which extends through the steel bulkheads into the dynamo room. To each turbine shaft there will be directly connected an electric generator of 375 to 400 K.W. capacity. There are at present installed 42 turbine units and 32 electric generators, 23 of the latter belonging to the Union Carbide Company, and 9 to the Michigan Lake Superior Power Company. The capacity of each generator belonging to the Union Carbide Company is 375 K.W., and of each of the generators belonging to the Power Company 400 K.W.

The delivery of water into the power canal is controlled by head-gates, located about 2,400 feet east of the intake entrance, at the beginning of the rock section of the canal. They consist of four-stories steel sluice gates, operated between masonry piers by hand winches and suitable trains of gear. The piers, gate sillsand abutments are all founded on rock. The gates are counter-steel and conbalanced for ease in operating. The piers between the gates are spanned by crete arches, making a bridge with ample strength for either railroad or street purposes.

The mean difference in height between the upper and lower levels of St. Marys river is about 19·3 feet. It is estimated that when the canal is operating to its full capacity the loss in frictional and other resistances to the flow of the water will be about 3 feet, making the mean effective head at the power-house about 16 feet or a little over.

The total cost of the Michigan Lake Superior Power Company's plant to date is $6,500,000.

6. THE WEST NEEBISH CHANNEL.

On Wednesday, the 15th, the sub-committee embarked again on board the steamship *Alfred Noble*, kindly placed at their disposal by the Office of the Corps of Engineers of the United States army at the Soo, to visit the new double track channel which is now being constructed. This will be another road through Hay lake and the West Neebish which will be completed in 1908.

Contract has been let for the construction of a channel 300 feet wide and 22 feet deep, for a distance of 13,300 feet through the rapids, with a stone retaining wall along each side of the rock cut. About 6,000 lineal feet of the cut was to be inclosed by cofferdams and the included portion of the channel is excavated in the dry. These intermediate dams shut off all flow of water through the West Neebish. The upper and lower main dams were partially constructed by a dredge casting over excavated material consisting of gravel, sand or clay, and finished by depositing stones and gravel until the height of the dam was about 6 feet above the water surface. The construction of these two cofferdams was commenced in August, 1904, and finished in August, 1905.

The contractors, at the close of the year 1904, had also made good progress in other preliminary works in connection with the construction of this 300-foot channel through the West Neebish rapids, including roadways, framing of cable towers for the Telferage system, boarding houses, store, dock and assembling of plant.

By the construction of the two temporary cofferdams, the water was raised three-quarter inches in pool above the upper dam. The contractors are employing, for the excavation of this solid rock bed, two air compressors of 750 and 250 horse-power respectively, and of 75 pounds pressure. The sides are first being channeled, and a vertical retaining wall is being built along each side of the channel to a height of six feet above low water. Drilling is done with 16 drills, and 50 per cent dynamite is used for blasting. The material is removed by four cableways, two of them 800 feet between the towers, and two of them 1,100 feet between the towers. The towers are 90 feet high. The skips used are steel, with dimensions of 8 x 8 x $2\frac{1}{2}$ feet. There is a steel shovel of 76 tons weight which is used in loading skips, and two more shovels of 120 tons each are to be added next spring. The average working force is 150 labourers and 49 skilled mechanics and foremen. There were 1,586,000 cubic yards of rock to be excavated above 22 feet grade at the rate of $1.36 per cubic yard, and 95,000 cubic yards between 22 and 23 feet grades are to be excavated at 68 cents per cubic yard. As above stated, this gigantic work was begun in May, 1904, and will probably be completed before the opening of navigation in the spring of 1908. That would make what we may call a double track channel of 300 feet from Sault Ste. Marie to Detour Point.

The mean level of Lake Superior for the years 1860 to 1904, both inclusive, is 602·29 feet above mean tide at New York. The discharge of the St. Marys river for this elevation of the lake, as measured in 1902, is 75,000 cubic feet per second. The increase in discharge per foot rise of lake is approximately 15,500 cubic feet per second.

The United States engineer of the War Department in charge at Sault Ste. Marie informed the sub-committee that they are now preparing a plan for a 25 foot channel, thus deepening the middle and west channels an additional four feet, without further widening. The material which has been excavated from the St. Marys river is silt, sand, clay, gravel, stones, boulders, hardpan, sandstones and limestone bed rock. The dredging operations are all conducted under contracts. The inspectors of dredging are paid by the United States government at the rate of $85 per month and their board while employed during the working season. The total amount spent up to the present time by the United States govern-

ment in improving St. Marys river is as follows: Canal, $8,000,000; river channel, $4,000,000; making a total of $12,000,000.

Returning to the Soo in the afternoon, the committee visited the plants and works of the Chandler-Dunbar Water-Power Company and those of the Edison Sault Electric Company.

7. THE CHANDLER-DUNBAR WATER POWER COMPANY, AND THE EDISON SAULT ELECTRIC COMPANY.

The Chandler-Dunbar Water-Power Company was incorporated in virtue of the same Act which gave legal existence to the Michigan Lake Superior Power Company, viz.: Act No. 39 of the Public Acts of the State of Michigan, to authorize the formation of a corporation for the purpose of excavating, constructing, and maintaining water courses with water-power appurtenant thereto, for accumulating, storing, conducting, selling, furnishing and supplying, upon an agreed rental, water and water-power for mining, milling, manufacturing, domestic, municipal, and agricultural purposes.

The Chandler-Dunbar Water-Power Company claim to have for many years past, the ownership of the south bank and shore of the St. Marys river at the rapids, in the city of Sault Ste. Marie, in the County of Chippewa, in the State of Michigan, from a point 700 feet above and west of, to a point of 2,300 feet below and east of the south end of the International Bridge, across St. Marys river, and also of the bed of the St. Marys over and against said rapids extending from the south bank and shore of said river northerly to the international boundary line between the United States on one side and the Dominion of Canada on the other side; and extending from above the head of the falls in the St. Marys river nearly to the foot of the said falls.

The volume of the flow in St. Marys river at the ordinary low water stage, at and past the land of the Chandler-Dunbar Water-Power Company, over and above the amount required for navigation, is, according to the Engineer of the company, about 3,600,000 cubic feet per minute, or 60,000 cubic feet per second. At higher stages the flow is naturally much more. There is, upon the lands of the company, a fall of the water to the extent of about 12 feet, according to an estimate of the Engineer of the company.

The Chandler-Dunbar Water-Power Company claim that at least half of this flow of water is appurtenant to the American shore and appurtenant to the lands of the company. It is, therefore, the intention of the company and its lessee, the Edison Sault Electric Company, to take and use, where it passes the lands of the company, for the production of available power all of such flow appurtenant to the said lands, excepting only such amount as may be required for navigation. The character of the proposed works is in each case a dam containing penstocks and wheels; the dam is designed to raise the level of water in the rapids, above the dam, to the level of Lake Superior, or as near as may be. The penstocks and wheels to have sufficient capacity to discharge and utilize all the flow of the rapids of the St. Marys river south of the international boundary. The penstocks will be provided with waste weirs for use when the wheels are to be stopped. The tailraces will be excavated to as low a level as circumstances will permit in order that the entire available head may be utilized.

The Chandler-Dunbar Water Power Company are building their present works in virtue of certain permits which have been granted them by the United States War Office, and they also claim the ownership of what is generally called Island No. 1 and Island No. 2, in virtue of letters patent, granted them on December 15, 1883. Said letters patent read as follows:—

'UNITED STATES OF AMERICA.

'To all to whom these presents shall come, Greeting:

'Special Act of Congress

'April 11, 1860.

'Whereas, in pursuance of the Special Act of Congress, approved April 11, 1860, entitled, "An Act for the relief of the legal representatives of Charles Porterfield, deceased," there has been deposited in the General Land Office, warrant No. 123, for 40 acres in favour of William Kinney and Thomas J. Michie, as executors of Robert Porterfield, deceased, or their assignees, should any assignment from them as such executors, under the provisions of the will of Robert Porterfield as directed by the Act in question, be duly indorsed thereon, and, whereas there is indorsed on said warrant an assignment duly executed in favour of William Chandler, with evidence that the same had been duly located upon all that certain lot or parcel of land, being a portion of section numbered six in township numbered forty-seven, north of range numbered one, east of Michigan meridian in the State of Michigan, designated upon the official plan of the survey of the village of Sault Ste. Marie, made by United States Deputy Surveyor Thomas Whelpley, in 1854 and 1855, under and by virtue of an Act of Congress, approved September 26, 1850, entitled, "An Act providing for the examination and settlement of claims for land at the Sault Ste. Marie, in Michigan," which survey was approved by Leander Chapman, United States Surveyor General for the state of Michigan, September 4, 1855, and is now on file in the office of the Commissioner of the General Land Office at Washington, D.C., as "part of the Indian reservation," said tracts being bounded by the River St. Marys on the east, north and west, and by the St. Marys Falls canal and portage street extended on the south, the same being more particularly described by courses and distance as follows: Beginning at the intersection of the principal meridian of Michigan with River St. Mary, being 90 links north of St. Mary's canal, and being the northwest corner of northeast part of claim No. 3; thence north 71 degrees, 39 feet east 4·00 chains; thence north 4 degrees, 37 feet west 3·65 chains the northwest corner of said tract, being the initial point of the survey of said tract; thence south 4 degrees, 37 feet east 1·00 chains; thence south 77 degrees, 10 feet west 15·00 chains; thence north 85 degrees, 23 feet east 18·89 chains; thence north 18 degrees, 39 feet west 2·06 chains; thence north 80 degrees, 40 feet west 1·66 chains; thence south 88 degrees, 15 feet west 4·01 chains; thence north 84 degrees, 41 feet west 4·06 chains; thence south 85 degrees, 23 feet west 3·00 chains; thence north 89 degrees, 54 feet west 4·01 chains; thence south 79 degrees, 57 feet west 4·02 chains; thence north 69 degrees, 19 feet west 4·42 chains; thence south 87 degrees, 56 feet west 8·9 chains, to the initial point of survey, being the northwest corner of the said tract containing 9·10 3-4 acres of land, more or less, in the district of land subject to sale at Marquette, Michigan according to the official plant of the survey of the said land returned to the General Land Office by the Surveyor General. Now know ye, that there is, therefore, granted by the United States unto the said William Chandler the tract of the land above described, to have and to hold the said tract of land with the appurtenance thereof, unto the said William Chandler and his heirs and assigns forever.

'In testimony whereof, I Chester A. Arthur, President of the United States of America, have caused these letters to be made patent, and the seal of the General Land Office to be hereunto affixed.

'Given under my hand at the city of Washington, the fifteenth day of December, in the year of our Lord, one thousand eight hundred and eighty-three, and of the independence of the United States the one hundred and eighth.

'(Seal)

'United States General Land Office.

'By the President, CHESTER A. ARTHUR.
'By WM. H. CROOK, *Secretary.*

'S. W. CLARK, Recorder of the General Land Office.
'Recorded, Vol. 6, Pages 1, 2 and 3.'

8. THE REVOCABLE LICENSES GRANTED BY THE UNITED STATES WAR DEPARTMENT TO THE CHANDLER-DUNBAR WATER-POWER COMPANY OR TO ITS LESSEE, THE EDISON SAULT ELECTRIC COMPANY.

They are seven in number and read as follows by order of dates:

Revocable License, No. 1 (March 14, 1898).

The Edison Sault Light and Power Company, of Sault Ste. Marie, a corporation existing under the laws of the state of Michigan, is hereby granted a license, revocable at will by the Secretary of War, to erect and maintain a dam on the rapids of the St. Marys river, between the mainland and Island No. 3, and within the limits of the lines marked 'Proposed Embankment Dam,' on the map hereto attached and made a part of this instrument, upon the following provisions and conditions:

1. That said dam shall be so constructed as not to interfere with private rights or public interests and improvements.

2. That the engineer officers of the United States Army, in charge of the district within which the dam is to be constructed may supervise its construction as far as may be necessary, to secure the compliance with the conditions herein obtained.

3. That any sum which may have to be expended, after revocation of this license, in putting any premises or property, hereby authorized to be occupied or used, in as good condition for use by the United States as it is this date, shall be repaid by said Edison Sault Light and Power Company on demand.

Witness my hand this fourteenth day of March, 1889.

(Signed) REDFIELD PROCTOR,
Secretary of War.

This license with the terms, provisions and conditions set out therein, is hereby accepted this fifth day of March, 1889.

THE EDISON SAULT LIGHT AND POWER COMPANY,
C. E. AINSWORTH, *President.*
E. S. B. SUTTON, *Secretary.*

Signed in presence of J. H. Goff, W. Chandler, Chas. G. Clarke, Thomas J. Martin and Frank Perry, all of Sault Ste. Marie, Michigan.

Revocable License, No. 2 (August 8, 1892).

The Edison Sault Electric Company is hereby granted a license, revocable at will by the Secretary of War, to construct and to maintain an embankment dam in the St. Marys rapids, adjacent to its property at Sault Ste. Marie, Michigan, and extending into the river to a point half the distance from the shore to Islands Nos. 1 and 2, in accordance with the general plan shown on the map hereto attached, upon the following provisions and conditions:

1. That no portion of the dam, except that extending to Island No. 3. shall be so constructed as to extend further than midway between the company's property and islands Nos. 1 and 2.

2. That the engineer officers of the United States Army, in charge of the district within which the dam is to be built, may supervise its construction as far as may be necessary to secure the compliance with the conditions of this license.

3. That any sum which may have to be expended, after revocation of this license, in putting any premises or property, hereby authorized to be occupied or used, in as good condition for use by the United States as it is at this date, shall be repaid by said Edison Sault Electric Company on demand.

Witness my hand this nineteenth day of August, 1892.

(Signed) L. A. GRANT,
Acting Secretary of War.

This license, with the terms, provisions and conditions set out therein, is hereby accepted this eighth day of August, 1892.

(Signed) EDISON SAULT ELECTRIC COMPANY,

By Harris, T. Dunbar, *President.*

Signed in presence of F. E. Dunbar.

Engineer's Department, 1892, No. 3390.

Revocable License, No. 3 (July 8, 1893).

The Edison Sault Electric Company is hereby granted a license, revocable at will by the Secretary of War, to enter upon the land of the United States, forming part of the St. Marys Falls Canal grounds, at Sault Ste. Marie, Michigan, and to widen the tail-race now in use by the said company, between its power house and Island No. 3, from 15 to 25 feet, and to extend the small embankment dam running down from the Island No. 3 to Island No. 4, all as shown on the attached plan of a part of the canal grounds, the red lines on the plan showing the extent of the proposed work, upon the following provisions and conditions:—

1. That unless sooner revoked, this license shall expire at the end of five years from the date of its execution.

2. That the excavated material shall not be removed, but it shall be deposited back (south) of its present position.

3. That any sum which may have to be expended, after revocation of this license, in putting any premises or property, hereby authorized to be occupied or used, in as good condition for use by the United States as it is at this date, shall be repaid by the said Edison Sault Electric Company on demand.

Witness my hand this sixth day of July, 1893.

(Signed) L. A. GRANT,
Acting Secretary of War.

Office, Chief of Engineers, United States of America, Inclosure 2 of 3081.

Received Office of Chief of Engineers, July 8, 1893.

Revocable License No. 4 (April 4, 1902).

Whereas, by revocable license, dated August 13, 1892, the Acting Secretary of War gave unto the Edison Sault Electric Company permission to construct and maintain an embankment dam in the St. Marys River rapids, adjacent to its property at Sault Ste. Marie, Michigan, and extending into the river to a point half the distance from the shore to Islands Nos. 1 and 2, in accordance with the general plan shown on the map thereto attached, and subject to the conditions therein contained;

And whereas, said Edison Sault Electric Company has now applied to the Secretary of War for a modification of said license of August 13, 1892, so as to permit the construction of the proposed new power station indicated at A-A1 on the attached blue-print, and to extend the present embankment, as indicated by the heavy white line from *a* to *c*, and to remove the red lined section *a*, *b* ; also to make a new tail-race outside of Island No. 3, at said place, all as shown on the attached blue print;

Now, therefore, this is to certify that the Secretary of War hereby modifies said revocable licenses of August 13, 1892, so as to permit the construction of a proposed new power station, indicated at A-A1 on the attached blue print, and to extend the present embankment, as indicated by the heavy white line from *a* to *b*, and to remove the red line section *a*, *b*, shown on said blue print; also gives unto said company permission to make a new tail-race outside of Island No. 3, at said place, as shown on said blue print, subject to the following conditions:—

1. That this permission shall not be construed as authorizing any invasion or impairment of the riparian rights of any other person or corporation, and the right to withdraw the permission for use of this tail-race whenever the interests of the government so requires, is expressly reserved.

2. That the work of cleaning and deepening the tail-race shall conform to the plan outlined in the company's letter of March 23, 1901, a copy of which is hereto attached.

3. That as soon as the new tail-race is ready for use said company shall abandon the tail-race now used on the inside of Island No. 3, and relinquish to the United States all rights of the company between said island and the shore.

4. That the work herein permitted to be done shall be subject to the supervision and approval of the Engineer Officer of the United States Army in charge of the locality.

5. That any sum which may have to be expended, after revocation of this license, in putting any premises or property, hereby authorized to be occupied or used, in as good condition for use by the United States as it is at this date, shall be repaid by said Edison Sault Electric Company on demand.

Witness my hand this fourth day of April, 1901.

(Signed) ELIHU ROOT,

Secretary of War.

Office, Chief of Engineers, War Department, April 6, 1901, No. 38452.

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The following letter is annexed to the preceding license, and forms part of the official records of the War Department in Washington:—

THE SHOREHAM,

WASHINGTON, D.C., March 23, 1901.

Honourable SECRETARY OF WAR, Washington, D.C.

SIR,—In addition to the plan of the proposed tail-race, for which we are making application to improve, and to which this is attached and made a part.

We would state that it is our desire to clear out the driftwood, loose boulders, rock and such other material as may be encountered, to a depth of not exceeding 10 feet below the present surface; this at a point where the property of our company on the east intersects with that of the government, and on the lines indicated by the plan herein referred to.

From this as a grade starting point, we wish to extend the improvement downstream on the lines indicated by our plan, gradually decreasing the depth of excavation as the slope of the bottom requires, until a plane is reached when no further excavation would be required, the natural surface and improved channel being on the same grade, at a point not lower down the channel than the westerly extremity of Island No. 5.

It is not intended or requested on our part to make any permanent embankments on either side of the excavation so applied for unless required by the government.

It is not expected on our part that after completing the improvements herein contemplated that we will change the volume of flow of water on the government property, which we now seek to utilize. It is hoped on our part to pass the same amount of water over the same areas as would naturally flow, concentrating its fall at a given point and utilizing it for commercial purposes, instead of as present the fall is diffused over a long distance and goes to waste.

Very respectfully,

EDISON SAULT ELECTRIC.

Revocable License, No. 5 (June 9, 1902).

The Chandler-Dunbar Water-Power Company, Sault Ste. Marie, Michigan, is hereby granted a license, revocable at will by the Secretary of War, to occupy for the purposes of the extension of said company's dock, a small area of land belonging to the United States government at Sault Ste. Marie, Michigan, as shown by red lines on the attached drawing, upon the following provisions and conditions:

1. That the United States shall have a perpetual right to the free use of said dock in the future, so far as needed for government work connected with future canal operations and improvements, at Sault Ste. Marie, Michigan.

2. That any sum which may have to be expended, after revocation of this license, in putting any premises or property, hereby authorized to be occupied or used, in as good condition for use by the United States as it is at this date, shall be repaid by said Chandler-Dunbar Water-Power Company on demand.

Witness my hand this ninth day of June, 1902.

(Signed) WM. CARY SANGER,
Assistant Secretary of War.

Office, Chief of Engineers, War Department, June 10, 1902, No. 42721

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Revocable License, No. 6 (March 10, 1904).

Whereas, by revocable license, dated August 13, 1892, the Acting Secretary of War gave unto The Edison Electric Company permission to construct and maintain an embankment dam, in the St. Marys River rapids, adjacent to its property at Sault Ste. Marie, Michigan, and extending into the river to a point half the distance from the shore to Islands Nos. 1 and 2, in accordance with the general plan shown on map hereto attached, and subject to the conditions therein contained;

And whereas, by an instrument dated April 4, 1901, the Secretary of War modified said revocable license of August 13, 1892, so as to permit the construction of a proposed new power station, indicated at A-A^1 on the blue print hereto attached, and to extend the embankment, as indicated by the heavy white line from *a* to *c*, and to remove the red line section *a b*, as shown on said blue print; and also gave unto said company permission to make a new tail race outside of Island No. 3, at said place, as shown on said blue print, subject to the conditions therein contained;

And whereas, said Edison Sault Electric Company has now applied to the Secretary of War for a modification of said permit of April 4, 1901, as hereinafter specified, so as to allow it to build out into the rapids of the St. Marys river, in front of the shore properties owned or leased by said company;

Now, therefore, this is to certify that, in accordance with the recommendation of the Chief of Engineers, the Secretary of War hereby modifies said instrument of April 4, 1901, so as to permit said company to build further out into the rapids of the St. Marys river, at said place; the work herein authorized being shown on the attached blue print, and specially described by reference thereto, as follows:

1. The removal of the wall and buildings (abB), coloured red.

2. The substitution of a somewhat larger power-house (EE) and a longer wall (a d), coloured yellow, in place of the already authorized power-house (AA^1) and wall (ac^1), coloured white.

3. The construction of a wider tail-race (GG^1) below the power-house, of width suited to the latter, in lieu of the old tail-race (f f^1).

These modifications are made on the following conditions:

1. That this permission shall not be construed as authorizing any invasion or impairment of the riparian rights of any other person or corporation, and the right to withdraw the permission for use of this tail-race whenever the interests of the government so require, is expressly reserved.

2. That the work of clearing and deepening the tail-race shall conform to the plan outlined in said company's letter of March 23, 1901, a copy of which is hereto attached.

3. That as soon as the new tail-race is ready for use, said company shall abandon the tail-race now used on the inside of Island No. 3, and relinquish to the United States all rights of the company between said islands and the shore.

4. That the work herein permitted to be done shall be subject to the supervision and approval of the engineer officer of the United States Army in charge of the locality.

5. That any sum which may have to be expended, after revocation of this license, in putting any premises or property, hereby authorized to be occupied or used, in as good condition for use by the United States as it is at this date, shall be repaid by said Edison Sault Electric Company on demand.

6. That the area now occupied by the old building and old tail-race shall be abandoned to the United States, as soon as the new buildings and new tail-race can reasonably be completed and ready for service.

Witness my hand this tenth day of March, 1904.

(Signed) WM. CARY SANGER,
Acting Secretary of War.

Office, Chief of Engineers, War Department, March 13, 1904, No. 38452.

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The letter annexed to the present patent is printed above with license No. 4.

WAR DEPARTMENT,

WASHINGTON, July 30, 1903.

GENTLEMEN,—Referring to previous correspondence concerning the suspension of the permission heretofore granted the Edison Sault Electric Company, to build its embankment dam, power house and other works farther out into the St. Marys River rapids at Sault Ste. Marie, Michigan, I beg to inform you that I have this day executed an instrument modifying the permit of March 10, 1903, granting the permission above referred to, so as to have thereto the following conditions:—

'That no part of the proposed embankment dam, power house and other works shall be so constructed as to extend farther into the river than one-half of the distance from shore to the nearer island of the Islands Nos. 1 and 2.

'That the present rock bottom in the river at the head of the rapids and head of the head race shall not be cut away or otherwise lowered or deepened.'

Very respectfully,

(Signed) ELIHU ROOT,

Secretary of War.

Messrs. Shaw, Warren, Cady & Oakes,

Attorneys for St. Marys Power Company, Detroit, Mich.

OFFICE OF CHIEF OF ENGINEERS,

December 23, 1903.

NOTE:—

Paragraph 7 of the notice of July 30, 1903, modified as follows: (See 17th ind. on 46393, and ind. of Acting Secretary of War, October 31, 1903, on 46393), viz.:—

'That no part of the proposed embankment dam, power-house and other works shall be constructed above a line extending from the foot of Island No. 2, at right angles to the general course of the channel between said island and the shore as to extend farther into the river than one-half of the distance from the shore to the nearer island of Islands Nos. 1 and 2; and that around the foot of Island No. 2, such construction shall leave at all stages of water a free water flow, at least equal in total cross section and volume to that now passing between Islands Nos. 1 and 2, and the nearest parts of the embankment of the August 13, 1892, permit.'

Revocable License, No. 7 (May 8, 1905).

Whereas, by instrument dated March 10, 1903, as subsequently modified by instrument dated July 30, 1903, permission was granted by the Secretary of War to the Edison Sault Electric Company, to construct an embankment dam, power-house and accessory works in the St. Marys river at Sault Ste. Marie, Michigan, as specifically described in said instrument of March 10, 1903, and shown on the map attached thereto; such permission, however, being subject to the conditions set forth in said instrument of March 10, 1903, as modified by said instrument of July 30, 1903;

And whereas, application is now made by said Edison Sault Electric Company for permission to make certain alterations in the proposed work and certain additional constructions in connection therewith; and the Chief of Engineers, United States Army, has recommended that permission be given to the extent hereinafter set forth;

Now, therefore, this is to certify that the Secretary of War hereby gives the said Edison Sault Electric Company permission for the construction of a temporary sand-bag cofferdam, as indicated in red on the attached blue print, and described by reference thereto as extending from the point G to Island No. 1, between Islands Nos. 1 and 2, and from Island No. 2 to the point F.

This permission, however, is given upon the following conditions:—

1. That the said temporary sand-bag cofferdam shall be entirely removed by said company not later than the close of navigation of the calendar year 1905.

2. That the work herein permitted and required to be done shall be subject to the supervision and approval of the engineer officer of the United States Army in charge of the locality.

Witness my hand this eighth day of May, 1905.

(Signed) WM. H. TAFT,
Secretary of War.

Office of Chief Engineer, War Department, May 15, 1905, No. 38452.

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54

The United States government has entered a suit in the Circuit Court of the United States for the Western District of Michigan, Northern Division, against the Chandler-Dunbar Water Power Company, claiming the ownership of Island No. 1 and Island No. 2, and asking that the letters patent granted them in 1883 be cancelled and declared void. The suit was commenced by the United States, under the direction of the Attorney-General, on September 2, 1903. All testimony and records and documentary evidence have been taken, and the case was heard last spring, and judgment was given on July 20 last, by Mr. Justice P. Wanty, dismissing the action of the United States government and maintaining the Chandler-Dunbar Water Power Company in their act of ownership to Islands Nos. 1 and 2.

The United States, as complainant, claims that it is the owner of Islands Nos. 1 and 2, situated in the rapids of the Straits of St. Mary, north of the ship canal and locks belonging to it; that said islands are situated in public waters, to which no riparian rights can be attached, and that the continued undisturbed ownership and possession thereof is essential to the present and future operation and enlargement of said works in aid of commerce, and also essential to enable the United States to fulfil its international obligations to Great Britain, by maintaining communicating waterways of the Great Lakes as public waters.

The defendant denies the public character of the waters in which said islands are situated, and asserts that the ownership of said islands attaches to the ownership of the adjacent shore title on the American side. The defendant also denies that said islands are needed by the United States for public purposes, and denies that their ownership and possession are essential to the performance of the international obligations of complainant.

The defendant claims to be the owner of said islands by virtue of a patent issued on December 15, 1883, to its grantor, William Chandler, asserting that said title attaches also to said islands by virtue of its riparian ownership.

The complainant claims that said islands, together with a quantity of land on the south shore of the straits, on a part of which a ship canal and locks are constructed and in operation, have been reserved since the year 1882, and at any rate since April 3 and September 2, 1847, for public purposes.

The defendant, while admitting such reservation in 1847, claims that said reservation has been released:

(*a*) By order of the President on December 9, 1852;

(*b*) By the abandonment of an Indian right of occupancy by a treaty, proclaimed April 24, 1856;

(c) By the Act of September 26, 1850, and the operations thereunder, such operations including the survey of the mainland at Sault Ste. Marie, by Thomas Whepley, in 1854 and 1855.

The complainant alleges that the tract patented to Chandler was not included in the Whepley survey and was never included in any other survey of the public lands, and that, therefore, the land was not subject to be taken by location with Porterfield Scrip, which is the basis of the Chandler title, under the very terms of the Act of Congress authorizing the use of such scrip.

The defendant alleges that this suit is not brought in good faith by the United States, but that its object, instead of being the assertion of the rights and duties set out in complainant's bill, is to assist a private corporation,the Michigan Lake Superior Power Company, to divert water from flowing past the land covered by defendant's alleged title.

The complainant insists that this suit is brought in good faith, for the objects and purposes set out in its bill.

The defendant also relies upon the Statute of Limitations of March 3, 1891, which provides that suit by the United States to vacate and annul any patent theretofore issued, shall only be brought within five years from said date.

The complainant insists that the patent issued to Chandler in 1883 was not voidable, but absolutely void, because the land embraced therein, being in a state of reservation, was not subject to disposal under the public land laws of the United States, and that a void title is not within the intent of said Statute of Limitations; and complainant insists, further, that said Statute of Limitations does not apply, because said title is also void for the reason that the land covered by said patent has never been surveyed into legal subdivisions, or at all, and was not, therefore, subject to a location by Porterfield scrip.

The defendant also alleges that the complainant is estopped by its dealings with the defendant and by its laches to deny the title of defendant to the upland alleged to be embraced in the patent to defendant's grantor.

As above stated, Judge Wanty maintained the plea of the Chandler-Dunbar Water-Power Company in the Circuit Court of the United States for the western district of Michigan, northern division. The Attorney General has appealed from that judgment to a higher court, and the question has not yet been argued.

9. THE CONSOLIDATED LAKE SUPERIOR POWER COMPANY.

On Thursday the committee again embarked on board the United States government steamer *Alfred Noble*, and went to the Canadian side to visit the plants of the Consolidated Lake Superior Power Company. This company was incorporated under the Revised Statutes of Ontario, chapter 164, as the Ste. Marie Water, Gas and Light Company, on June 30, 1888. By chapter 88, of the Ontario statutes, 1889, the company's name was changed to 'The Ontario Water, Light and Power Company.' By section 4 of this Act, the company obtained the power to build dams across the island channels or rapids of the St. Marys river or of any branch within the province of Ontario, and also to conduct water from the said river and the various branches thereof for hydraulic purposes; also to make flumes, canals or other works to secure the necessary supply of water for their works. The provisions of the section were to be exercised only with the consent of the Crown or the individuals affected. The company was also authorized to sell, lease or otherwise dispose of surplus water from their dams, flumes or canals. By the Ontario Act of 1890, chapter 135, the corporation of Sault Ste. Marie was authorized to take stock in the Ontario and Sault Ste. Marie Water, Light and Power Company, and an agreement with this view was ratified and is annexed to chapter 135, above described.

By the Ontario Act of 1895, the name of the company was changed into 'The Lake Superior Power Company,' all rights, powers and privileges to be

enjoyed as theretofore granted. The St. Marys island, containing an area of 170 acres, was part of the military lands, expressly vested in the Crown for the purposes of the province of Canada by the Act 19 Vic., chapter 45, section 6 (1856). The northerly portion, comprising 10·10 acres of St. Marys island, which belonged to the Dominion as ordnance lands, was granted by way of exchange of properties to the Lake Superior Power Company by Dominion letters patent, dated March 19, 1896. They covered the said parcel of land and land covered with water, being a portion of St. Marys island and the adjacent waters, and reserved the free use of all navigable waters that might thereafter be found on, under, or flowing through, or upon any part of the land. These letters patent read as follows:—

'Special grant by Her Majesty the Queen to the Lake Superior Power Company, of parcel or tract of land and land covered by water, being a portion of the St. Marys island and the adjacent waters, being in the town of Sault Ste. Marie, in the district of Algoma, Ontario, dated March 18, 1896, recorded March 19, 1896.

'J. POPE,

'*Acting Deputy Registrar General of Canada.*

'JOHN J. McGEE,
'*Deputy Governor.*

CANADA:

'Victoria, by the Grace of God, of the
'United Kingdom of Great Britain and
'Ireland, Queen, Defender of the Faith.
'etc., etc., etc.

To all these presents shall come, Greeting:

'Whereas the lands hereinafter described have been required for a public work of Canada, and the same are no longer required for such public work;

'And whereas, pursuant to the Statutes and under the authority of our Governor in Council in that behalf, we have agreed to grant the said lands to Lake Superior Power Company, hereinafter called 'the said company,' in exchange for certain other lands, situated at the town of Sault Ste. Marie, in the province of Ontario, and the said last mentioned lands have been duly conveyed to us by 'the said company.'

Now know ye, that in consideration of the premises, we do grant, convey and assure unto 'the said company' all and singular that certain parcel or tract of land and land covered by water, being a portion of St. Marys Island and the adjacent waters, situated, lying and being in the town of Sault Ste. Marie, in the District of Algoma, and province of Ontario, and which may be more particularly known and described as that portion of St. Marys Island and adjacent waters, the property of the government of the Dominion of Canada, lying to the north of a straight line to be hereinafter described, and bounded on the west by the southerly production of the easterly limit of West street, and on the east by the Laird & Henderson mill site (a tract of 12 acres, granted by Letters Patent, dated June 7, 1877, to John Laird and Jonathan Henderson); the above mentioned straight line is drawn from a point on the southerly production of the easterly limit of West street, distant one thousand one hundred and forty-nine and four-tenths (1,149 4-10) feet, measured southerly along said production from the southerly limit of Portage street to a point on the southerly production of the westerly limit of Andrew street, distant nine hundred and thirty-six and four-tenths (936 4-10) feet, measured southerly along said production from the said southerly limit of Portage street; the above described parcel contains

by admeasurement ten and ten hundredths (10·10) acres, be the same more or less, and is shown coloured pink on a plan hereto annexed, saving, excepting and reserving unto us, our successors, and assigns the free uses, passage and enjoyment of, in, over and upon all navigable waters that shall or may be hereafter found on, or under, or be flowing through, or upon any part of the said parcel or tract of land hereby granted as aforesaid.

'To have and to hold the said parcel or tract of land unto 'the said company,' its successors and assigns forever.

'Given under the Great Seal of Canada:

'Witness: John Joseph McGee, Esquire, Deputy of Our Right Trusty and Right Well-Beloved Cousin and Councillor the Right Honourable Sir John Campbell Hamilton Gordon, Earl of Aberdeen, Viscount Formatine, Baron Haddo, Methlic, Traves and Kellie, in the Peerage of Scotland; Viscount Gordon of Aberdeen, County of Aberdeen, in the Peerage of the United Kingdom, Baronet of Nova Scotia, Knight Grand Cross of our Most Distinguished Order of Saint Michael and Saint George, etc., etc., Governor General of Canada.

'(E. L. Newcombe, Deputy of the Minister of Justice, Canada.)

'At our Government House, in our City of Ottawa, this eighteenth day of March, in the year of Our Lord, one thousand eight hundred and ninety-six, and in the fifty-ninth year of our reign.

'JOHN HAGGART,
Minister of Railways and Canals.

'By Command:

'JOSEPH POPE,
'Acting Under Secretary of State'.

The Lake Superior Power Company are at present the owners of the Laird & Henderson mill site, which comprised a certain area of water and islands therein north of St. Marys island. This mill site had been granted by Letters Patent from the province of Ontario on June 7, 1877, to John Laird and Jonathan Henderson. Said Letters Patent read as follows:—

D. A. MACDONALD,

'PROVINCE OF ONTARIO,

'Victoria, by the Grace of God of the
'United Kingdom of Great Britain and
'Ireland, Queen, Defender of the Faith.

'To all to which these presents shall come, Greeting:

'Whereas, John Laird, of the town of Sault Ste. Marie in the District of Algoma, miller, and Jonathan Henderson, of the same place, merchant, have contracted and agreed for the absolute purchase of the lands and tenements hereinafter mentioned and described at and for the price of or the sum of twelve dollars of lawful money of Canada, and of which lands we are seized in right of our Crown.

'Now know ye, that in consideration of the said sum of twelve dollars, well and truly paid to our use, at or before the sealing of these, our Letters Patent, we have granted, sold, aliened, converted and assured, and by these presents do grant, sell, alien, convey and assure unto the said John Laird and Jonathan Henderson, their heirs and assigns forever:

'All that parcel or tract of land and land covered with water, situate, lying and being at the town of Sault Ste. Marie in the District of Algoma, in the province of Ontario, containing by admeasurement twelve acres, be there more or less, which said parcel or tract of land may be otherwise known as follows, that is to say: Being composed of a mill site at the town of Sault Ste. Marie, in front of the township of Awenge, as shown by the green colour on a plan by provincial land surveyor, Isaac Traynor, dated May 5, 1877, of record in the Department of Crown Lands, a copy of part of which plan is attached to these Letters Patent, together with the right of way one chain wide from the said mill site to the Korah road, as shown on the said plan by the red colour.

'To have and to hold the said parcel or tract of land hereby granted, conveyed, assured unto the said John Laird and Jonathan Henderson, their heirs and assigns for ever, saving, excepting, and reserving, nevertheless, unto us, our heirs and successors, the free uses, passage and enjoyment of, in, over and upon all navigable waters that shall or may be hereafter found on, or under, or be flowing through, or upon any port of the said parcel or tract of land hereby granted as aforesaid

'Given under the Great Seal of our province of Ontario.

'Witness, the Honourable Donald Alexander MacDonald, Lieutenant Governor of our province of Ontario;

'At Toronto, this seventh day of June in the year of Our Lord, one thousand eight hundred and seventy-seven, and in the fortieth year of our reign.

'By command of the Lieutenant-Governor in council.

'ARTHUR S. HARDY, C.L.S.,

'Secretary.

'THOMAS H. JOHNSTON,

'Assistant Commissioner of Crown Lands.

'Ref. 41,125; Toronto, 37,551; F.D.W.F.'

The Lake Superior Power Company also acquired from H. C. Hamilton and his wife a piece of land adjacent to the Laird and Henderson mill site, by a deed, executed on June 30, 1890, and duly registered at the registry office of the district of Algoma, in the town of Sault Ste. Marie, Ontario.

The present industrial activity and development at the Soo may be said to date from October, 1894, when an agreement was entered into between Francis H. Clergue of New York city, and Edward V. Douglas, of Philadelphia, for the purchase of the Ontario and Sault Ste. Marie Water, Light and Power Company. This company was originally formed for the development of power from the falls of the St. Marys river on the Canadian side, but after doing a certain amount of work, including the partial construction of a power canal, found itself financially embarrassed and unable to properly proceed with the completion of the work so that a revenue could be derived from it. The town of Sault Ste. Marie was practically the owner of the company, only a part of the capital stock being held by individuals. The company, in addition to their power privileges, were also the owners of franchises from the town of Sault Ste. Marie for electric lighting, water and street railway privileges. The transactions of Messrs. Clergue and Douglas are a matter of public record, and can be found in chapter 119 of the statutes of Ontario for the year 1895. Under this Act, which was assented to April 16, 1895, Mr. Clergue and his associates took over the complete property and franchises of the Ontario and Sault Ste. Marie Water, Light and Power Company. The name of the company at the same time being changed to the Lake Superior Power Company.

The Tagona Water and Light Company had already been organized in October of 1894 by Messrs. Clergue and Douglas; and its incorporation was confirmed by the same Act above referred to. This company was assigned the water and lighting privileges in the town of Sault Ste. Marie, and subsequently installed and are now operating an up-to-date water and lighting system.

The new company, viz: The Lake Superior Power Company, which was composed of Mr. Clergue and his associates, immediately commenced the development of water-power on the Canadian side of the St. Marys falls. They utilized, as far as possible, the old power canal, but increased its size to provide for much larger development of power, and constructed a suitable power-house for the development of electrical power from the water wheels, in which the Tagona Water and Light Company were provided with a pumping and lighting station.

The Sault Ste. Marie Pulp and Power Company was also provided with mill accommodation in the same group of buildings. These buildings are of solid stone construction and of modern type, Lake Superior limestone being used, quarried from the company's own property. This company was incorporated in 1895, and was an allied company of the two others above mentioned, the promotors being the same. It was first planned to make mechanically ground wood pulp under the wet process, but, after manufacturing wet pulp for a time the mill was changed to make dry pulp, and has been operating under this process ever since. The manufacture of pulp marked the commencement of Sault Ste. Marie as a manufacturing town, and consequently a new area of activity.

The promoters of the company mentioned above, realizing the vast natural resources of the district, rapidly proceeded with the inauguration and incorporation of various new industrial and transportation companies, a brief description of which follows. The town and district naturally profited greatly from these developments, entailing as they did the expenditure of vast sums of money for labour and material in their midst.

The Lake Superior Power Company did not confine itself to the development of power alone, but early began the exploration of the surrounding districts for minerals, and met with such success, with respect to iron and nickel finds, as to warrant the construction of plants for the treatment of these ores. Blast furnaces for the smelting of iron ores and a steel rail mill were built, together with operatives' houses; and for the utilization of the hardwoods of the district contiguous to the Soo a charcoal by-product plant and kilns were constructed. The charcoal from these plants was used in one of the blast furnaces. A reduction work was built for the treatment of nickel ore, one of the features of this process being the saving of the sulphurous gas for use in the manufacture of sulphite pulp. This company was meanwhile successfully operating the Helen Iron mine and the Gertrude Nickel mine.

The blast furnaces, steel plant and charcoal plant were originally constructed by the Lake Superior Power Company, but in the year 1901 were turned over to the Algoma Steel Company.

The Lake Superior Power Company had also become the owner by purchase of large areas of real estate in and around Sault Ste. Marie, and particularly on the river front, where it built docks, and otherwise held the land to provide for the expansion of itself and the other allied companies.

The Sault Ste. Marie Pulp and Paper Company built in addition to its ground wood pulp mill a large and handsome sulphite mill, and also commenced the manufacture of building paper and tar paper.

With so much construction and operation going on it was soon found necessary to have a workshop of sufficient capacity to take care of all repairs and a great part of new work. This was started on a comparatively small scale, but the demands upon it were so large that it was found essential to extend it. This was done from time to time, until finally the Algoma Iron Works was formed, and a splendid modern machine shop with galleries for small work

constructed with modern machinery sufficient to do the repairs of all the different departments of the various companies was installed. The blacksmith and tin shops were also added, and an up-to-date foundry for casting iron, brass and copper was built. These are all operating at the present time. This concern not only does repairs for the various companies, but it also handles a great deal of outside work, including marine repairs, of which work it makes a specialty.

Railroad facilities were naturally required to provide for handling ores from the mines and forest products, as well as switching at the various plants, and the Algoma Central Railroad was incorporated August 11, 1901, to serve this purpose, and in addition to a railroad of 120 miles, it owns and operates a fleet of vessels trading out of Sault Ste. Marie, consisting of four passenger boats and six freight boats. As part of the transportation plant of the company, the Manitoulin and North Shore Railway was incorporated July 7, 1901. Both of these railroads were the recipients of land grants from the Ontario government, the conditions of which can be obtained in the statutes.

The construction of these transportation lines was carried on by the Algoma Commercial Company, formed for this purpose, as well as for the purpose of carrying on mining and lumbering operations, the latter operation including the supply of pulp wood through the mill of the pulp company, and that of saw logs and veneer logs to its own saw and veneer mills at the Soo, the saw mill having a daily capacity of 100,000 feet, and the veneer mill being the largest in Canada. This company also built a car building plant at the Soo with a capacity of eight flats or four box cars per day. It further made extensive explorations for minerals, including iron, nickel and gold. The company owns at present the Josephine mine, which is a bessemer iron mine, the Grace gold mine and the Elsie nickel mine.

The right to operate street car lines had also been granted to the companies under the original franchise, and the International Transit Company was formed for the purpose of operating electric street car lines in the town of Sault Ste. Marie, Ontario, and also a ferry on St. Marys river between the two Soos. An up-to-date electric railroad was constructed and is at present operating. The equipment of the company also includes two ferries, the 'Algoma' and the 'Fortune'. These are modern ferry boats and have sufficient capacity to easily handle the traffic.

In the year 1901, the various companies were consolidated under the ownership of the Consolidated Lake Superior Company. The individual companies were made subsidiary to this company in that the Consolidated was a holding company and owned the stock of the various companies, the companies, however, preserving in every way their corporate existence. The subsidiary companies were reorganized in the year 1904 under the title of the Lake Superior Corporation, which at present is the holding company.

Before the advent of these companies the town of Sault Ste. Marie had a population of 2,000. There were no factories of any kind in the place, and the community did a very small business except a certain amount of trading. The construction of the large factories of the allied companies immediately gave a great impetus to the town. The population has steadily increased, until at the present time it is estimated that the population is 15,000. The works and properties of the allied companies cover an acreage of 1,600 and a total of about 4,000 men find employment. The town is in a prosperous condition, and is certain to become one of the great manufacturing centres of the country.

The following is a list of the various companies with the different plants operated by each, together with the number of men employed:—

Tagona Water and Light Company—

Municipal system of electric lighting and water supply; employs twenty men; eighty-eight miles of electric wire; twenty miles of water main.

Lake Superior Power Company—

Owners of the Canadian Power Plant; nickel reduction works, Gertrude nickel mine and smelter; brick plant; large acreage real estate; Helen iron mine; two hundred and twenty-five men employed.

Sault Ste. Marie Pulp and Paper Company—

Ground wood mill, 110 tons daily capacity; sulphite pulp mill—50 tons daily capacity; building paper and tar paper mill, 20 tons daily capacity; one hundred and seventy-five men employed.

Algoma Iron Works—

Large modern machine shop, blacksmith shop, tinsmith shop, pattern shop, brass, iron and copper foundry; employs one hundred and fifty men.

Algoma Steel Company—

Two blast furnaces, daily combined capacity 450 tons; steel plant, 600 tons steel rails daily capacity; charcoal retort plant, daily capacity 8,000 bushels charcoal, 1,600 gallons wood alcohol, 24,000 pounds gray acetate of lime; thirteen hundred men employed.

Algoma Central and Hudson Bay Railway Company—

One hundred and twenty miles of standard railroad under operation, fully equipped with modern rolling stock; steamship line consists of four passenger and six freight boats, also operates four docks; three hundred and fifty men employed.

Manitoulin and North Shore Railway Company—

Thirteen miles of standard railroad under operation, fully equipped with modern rolling stock, operated between Sudbury and Gertrude mine; thirty men employed.

International Transit Company—

Operates standard electric street car line in the town of Sault Ste. Marie, Ontario, providing eight minute service; also operates ferry service between the two Soos, owns two ferries; fifty men employed.

Algoma Commercial Company—

Operates saw mill, daily capacity 100,000 feet lumber; veneer mill, largest in Canada; car building plant, capacity eight flats or four box cars per day; large lumber operations, extensive mining property in districts around the Soo; employs eighteen hundred men.

The site of the power canal of the company is on certain streams between the islands originally existing in the rapids, and the intake is below the crest of the rapids from a natural bay in the river. The canal from the head-gates to the power house is 2,200 feet long, and the tail-race from the power house to the dredged channel opposite the north and south docks of the Lake Superior Power Company, is about 1,000 feet long. The canal is trapesoidal in section, with an earth and rock bottom and earth banks, the canal sides of which are paved with riprap. It is about 220 feet wide at the water line and about 12½ feet deep at the head gates, changing gradually to a width of 85 feet and a depth of 15½ feet at the power house. The head gates, which are constructed of wood, are located about 70 feet west of the Canadian Pacific Railway where it crosses the power canal. The power is developed by 42-51 inch vertical turbines, and at mean head is about 15,000 horse-power at the turbine shafts. To develop additional power would require either the enlargement of the present

canal or the construction of a new canal. The amount that could be developed depends upon the division of the flow of the river for utilization in United States and Canadian territory. The total flow of water, when all water wheels are running to their full capacity, is about 8,800 cubic feet per second, but the average flow is about 7,000 cubic feet per second.

The compensating works erected by the Lake Superior Power Company at the request of the United States War Department for the waters diverted through the canal of the Michigan Lake Superior Power Company on the American side, are located about 150 feet west of the centre line of the International Bridge, opposite spans Nos. 9 and 10, which are those nearest to the Canadian shore. They consist, as at present constructed, of an earth and rock fill dam opposite span No. 10, and a series of four stone and steel sluice gates opposite span No. 9. These gates leave a clean waterway opening each between stone and concrete piers of 52 feet 2½ inches, and the elevation of the sill of the gates is 591, or about 10½ feet below mean water level. The gates are counter-weighted and operated by hand by means of suitable trains of gears. The cost to date is about $267,000. The result accomplished by the compensating works with the gates closed is to reduce the flow through the rapids section by about 10,000 cubic feet per second at mean water level of 601·5 feet above mean tide water at New York city. As the gates have not been opened since construction, no data can be given as to the effect on flow under such a condition.

The Lake Superior Power Company claimed at first to have constructed these compensating works under the authority given it by Acts of the legislature of the province of Ontario, and more particularly by section 4 of chapter 88, 52 Victoria, page 311 of the statutes of Ontario, which reads as follows:—

'After having acquired the land or property necessary for the carrying out of the works hereinafter mentioned, the company shall have the power to erect engines and employ hydraulic power, and for such purposes to erect, construct and maintain a dam or dams across the inland channels or rapids of the St. Marys river, or of any branch thereof within the province of Ontario, and also to conduct water from the said river and the various branches thereof, and streams entering therein by canals or flumes to be made by the company at any place on the said rapids along the shores thereof for hydraulic purposes, and may also construct all necessary docks, wharfs and other works on the canals, and may extend its work into, and take possession of the bed and beach of the said St. Marys river at the entrance of the canals or flumes, and for the foundation of the same and in their entire length, and at any point at which it may be found expedient to provide an outlet or outlets for the waters of the canals or flumes, or tail-races for water-powers taken from the said canals or flumes; the company may, for the purpose of survey, enter upon all lands on the line of the rapids, and from time to time may purchase, acquire, hold and enjoy all lands necessary for all the above purposes, and such ditches as may be necessary along the banks of the said river and streams, or for a road or either or both sides of the river branches, canals and flumes; the company may make all bridges, intersection, crossings whether through, under, or upon public or private roads, or any aqueduct or canal, and may erect all necessary dams, piers, wharfs, raceways, flumes, canals, or other works to secure the necessary supply of water for the works, and may construct and maintain such buildings, mills, machinery, tramways, or railways and switches, wharfs and piers, dams, canals, raceways, and other conduits and works as may be requisite or may be deemed advantageous for carrying on the business of the said company; provided that it shall be responsible for all damages arising from inundations, if any, which its dams may cause, and all damages which may be caused by the carrying out or maintenance of any of its works; provided that nothing herein contained shall be held to confer the right of expropriating any land or interest therein, or any water or other privilege,

and the provisions of this section, so far as they affect or may affect the rights or interests of the Crown or any individual, shall be taken advantage of and exercised only with the consent of the Crown or such individual in that behalf first obtained.'

The company claims, having been advised by its then solicitor and subsequently by the law officers of the government of Ontario, that the title to and jurisdiction over the lands under the water on the Canadian side of the river and all the riparian rights appertaining thereto, including those of water-power and hydraulic developments, were vested in the Crown, as represented by the province of Ontario, and in the legislature of the province of Ontario, respectively, and as the works were constructed at a point where it was believed the works did not interfere with navigation, counsel for the company at the time advised that no consent or permission from the Dominion government was necessary.

The solicitors of the company further stated that some time after these works were constructed, and during a visit to Sault Ste. Marie of the Honourable Mr. Tarte, the then Minister of Public Works, and Mr. Coste, late Chief Engineer of the Public Works Department, and at the time employed by said department as supervising engineer of the works in course of construction at Port Colborne, Ont., the compensating works were inspected, and Mr. Coste suggested to Mr. F. H. Clergue, who was then president of the company, to apply to the Dominion government for approval of the works then constructed. The present directors of the Consolidated Lake Superior Power Company now understand from Mr. Clergue that, while not conceding that the action of the company at the time had not been regular and proper, he intended making the application suggested by Mr. Coste, his understanding being that the Minister of Public Works and Mr. Coste were satisfied with the construction, and that it would only be necessary to present a formal application under the statute to obtain the approval of the government, subject, of course, to such reasonable regulations respecting the operation of the compensating works as the Minister of Public Works might see fit to impose. Owing to Mr. Clergue's retirement from the management of the company and the subsequent financial difficulties which befell the company, the matter was overlooked, and it only came to the attention of the directors of the present Consolidated Lake Superior Power Company when the sub-committee, in visiting the compensating works at the Soo, asked under what authority they had erected the same. The company has, through its solicitor, filed the formal plans and description of the site with the Public Works Department and with the registrar of deeds at Sault Ste. Marie. The company, while not conceding that its action has been in any way irregular, is quite prepared to accept the approval of the Dominion government, subject to such reasonable regulations as may be imposed respecting the operation of the compensating works.

The application should have been made from the start, in virtue of chapter 92 of the Revised Statutes of Canada, entitled 'An Act respecting certain works constructed in or over navigable waters.'

The engineers of the company report that the mean flow of the St. Marys river, including that through the rapids, power canals and ship canals, has been for the last 24 years about 73,600 cubic feet per second. They further report that it appears probable from the data which they have that the amount of power which can be developed from the flow of the rapids is, commercially speaking, governed not by the mean flow for a period of 24 years, but is that which can be developed from the mean flow from the rapids during years of low water. Under the best conditions that can be obtained with a very complete system of compensating works in the rapids, the flow can probably be regulated so as to obtain a mean annual discharge in the years of low water of about 60,000 cubic feet per second.

10. THE CANADIAN SHIP CANAL.

The sub-committee, after having visited thoroughly all the plants and the works of the Consolidated Lake Superior Water-Power Company at Sault Ste. Marie, Ont., re-embarked on board the United States government steamship *Alfred Noble*, for a visit to the Canadian and American locks. Mr. J. C. Boyd, superintendent of the Canadian canal, accompanied the members of the sub-committee.

The length of the Canadian lock between the extreme ends of the entrance piers was, at the end of the season of 1904, 6,767 feet. During the season of navigation of 1905, another 800 feet has been added, which, when completed, will make a total length between the extreme ends of the entrance piers of the Canadian canal of 7,567 feet. There is only one lock of 900 x 60 feet, and it is of solid masonry. The depth of water on sills at lowest known water level is 20·3 inches. But the mean depth on the mitre sills is 22 feet. The total rise or lockage is 18 feet. The breadth of the canal at bottom is 141·08 and the breadth at surface of the water is 150 feet. This canal has been constructed through St. Marys island, on the north side of the rapids of the River St. Mary. The approaches to the canal are channels dredged through boulder shoals. The superstructure of the entrance piers is concrete. The gates and culvert valves are operated by electricity.

On October 13, 1904, the masts for day marks, from which fixed red lights were exhibited to mark the axis of the channel leading to the lower end of the Canadian canal, have been replaced by square, open skeleton, galvanized iron, unpainted towers with sloping sides, surmounted by square wooden lanterns, from which red lights are shown. Each light consists of three incandescent electric lamps, which show strong beams in the line of range and over a small are on each side thereof. On the channel side of each tower is a white, diamond-shaped day beacon of slatwork.

The front tower is 62 feet high and stands on the shore of the bay north of the entrance to the canal; its light is 63 feet above the water level below the canal and is visible 2·3 miles. The back tower, 72 feet high, is 1,150 feet north of the front light; its light is 78 feet above the river level and is visible 2·3 miles.

To enter the canal from below, the two lights are brought in range opposite the power-house, and kept thus until the axis of the canal is reached.

A railway drawbridge crosses the canal with a drawspoon of about 144 feet 5 inches clear width between the canal walls, and 15 feet clear height above low water surface. The draw does not sound any whistle, and the closure of the draw is indicated by the waving of flags from the end of the bridge. Boats sound three whistles as a request for opening the draw if it be found closed. The bridge if closed at night, shows a red light.

The Canadian canal was built between the years 1888 and 1895, and the cost with approaches was $4,000,000.

The Department of Railways and Canals is making extensive improvements at the west or upper entrance of the canal. The eastern or lowest entrance has been deepened to 21·5 feet and to a width of 315 feet. The south pier was originally only 130 feet long. To this a concrete extension has been built 800 feet long, as above stated, making the total pier length 930 feet. This work was completed during the season of 1904.

During the season of 1905 the west or upper entrance has been deepened to a depth of 21·5 feet, and a width from 300 to 500 feet. The work has been in progress during all summer, under contract. The south pier at the west entrance was originally 1,265 feet in length. To this an extension 800 feet long is now being built, under contract. When this extension is completed the length of this pier will be 2,065 feet.

The first lock which was ever built on the Canadian side of the river was erected by the Hudson Bay Fur Company, in 1798. It was 38 feet long, 8·9 feet wide, with a lift of 9 feet. A towpath was made along the shore for oxen to pull the vessels and canoes through the upper part of the rapids. This lock, excepting its timber floor and mitre sills, was destroyed in 1814 by United States troops from Mackinaw island, under command of Major Holmes. This lock has been restored and is to be seen near the general offices of the Consolidated Lake Superior Power Company. The Hudson Bay Fur Company also built a block house nearby to protect the locks from the attacks of Indians, and this structure has been restored, and is now one of the attractions of the Soo, for the double reason of its being what it is and because it was the first home of Francis H. Clergue in the Soo.

11. THE UNITED STATES SHIP CANAL.

After this lock, the first of real consequence was the state lock built on the American side by the state of Michigan, from 1853 to 1855. The canal was 1½ miles long, 64 feet wide at the bottom, 100 feet wide at the water surface and 13 feet deep. There were two tandem locks of masonry, each 350 x 70 feet, having 11½ feet on the mitre sills and a lift of about 9 feet each. The locks were destroyed in 1888 by excavations for the present Poe lock. The Weitzel lock, 515 feet long, 80 feet wide in chamber, narrowing to 60 feet, at the gates, was built by the United States in the years 1870 to 1881. It was opened to navigation on September 1, 1881. The depth of water on mitre sills is 17 feet when the upper pool is 601·9 and the lower pool 584·4 feet above mean tide at New York. At the same time the depth of the canal was increased to 16 feet, the mean width to 160 feet, and the stone slope walls were replaced with timber piers, having a vertical face.

The Poe lock, 800 feet long, 100 feet wide, and having 22 feet of water on the sills, was built by the United States in the years 1887 to 1896. Hydraulic power is used for operating the two American locks, a pressure of 115 pounds per square inch being used for the Weitzel lock machinery and a pressure of about 200 pounds for the Poe lock machinery.

A railway drawbridge crosses the canal at a point about 3,000 feet above the head of the locks and about 300 feet above the movable dam. The clear width of draw opening between canal walls or piers is about 114 feet 5 inches, and the clear height of draw above the low water surface is about 15 feet. For passage of trains, the draw sounds one whistle, then closes, then sounds six whistles answered by two whistles from the waiting locomotive. After passage of train the draw is opened without further signal. Boats sound three whistles, as requested, for opening the draw if it be found closed. The bridge, if closed at night, shows a red light.

This bridge is continued across the St. Marys river at the head of the rapids by ten fixed spans, each of approximately 232 feet clear width and 15 feet clear height above water surface.

During the fiscal year ended June 30, 1904, 16,120 vessels passed through the Canadian and the two American locks. These vessels had a total registered tonnage of 24,364,138 tons, and they carried 31,546,106 tons of freight, and 37,695 passengers.

From the opening of the season of navigation of 1905, to November 30, inclusive, the statistics of the traffic through Canadian and American locks are as follows:—

Through the	American	locks,	15,614 vessel passages
" "	Canadian	"	5,495 " "
" "	American	"	9,507 lockages
" "	Canadian	"	3,910 "
" "	American	"	30,360,448 registered tonnage
" "	Canadian	"	5,403,906 " "
" "	American	"	37,641,105 tons of freight
" "	Canadian	"	5,359,368 " "
" "	American	"	28,315 passengers
" "	Canadian	"	25,741 "

These figures are from the opening of navigation to and including November 30, 1905.

The inspection of the ship canals ended the visit of the sub-committee to Sault Ste. Marie. Before separating a resolution was passed thanking the officers of the Corps of Engineers of the United States Army at Sault Ste. Marie, Michigan, and in particular Mr. L. P. Morrison, junior engineer in charge, for the great courtesy they had extended to the members of the sub-committee during their inspection of the conditions at the Soo.

Mr. Clinton left to return home in Buffalo, and the Canadian section of the sub-committee proceeded to Duluth via Port Arthur and Fort William, to make a preliminary investigation into the proposed works of the Minnesota Canal and Power Company. They left Friday, August 18, by the Canadian Pacific Railway Company's steamship *Athabaska* at 3 p.m., and arrived at Port Arthur the following day at 12 noon, covering the distance between Sault Ste. Marie, Ontario, and Port Arthur in about twenty-two hours. The weather being exceptionally fine they had a splendid opportunity of examining thoroughly the conditions of the navigation on Lake Superior, and to obtain valuable information.

12. ST. MARYS RIVER WEST OF THE SHIP CANALS AND WHITEFISH BAY.

Shortly after having left the western end of the Canadian ship canal, the vessel passed near the Vidal shoal, situated at about 1½ miles above the rapids, between the United States and the Canadian channels. The removal of that shoal is of paramount necessity, as it is a source of great danger to vessels, particularly in foggy weather.

The route of the vessels off the Vidal shoal is in a direction southwest up to a point opposite Pointe au Chene, Ontario, where it turns in a direction northwest and follows it in a straight line to Ile Royale. At that point the route makes a little turn to the north, as far as Pie island and Thunder cape, thence proceeding again northwest to Port Arthur.

The ships enter Lake Superior properly at a point opposite Gros cap, Ontario, and Point Iroquois, Michigan. The distance between Sault Ste. Marie and Gros cap is about 30 miles.

13. LAKE SUPERIOR.

Lake Superior is the largest of the great lakes and also the largest area of fresh water on the globe. It is characterized by deep water and by high and rocky shores along a large portion of its coast. Compared with the other great lakes, its surface is more elevated above the sea; it is more irregular in outline, has deeper and colder water, more fog, more ice, a shorter season of navigation, less rain, about the same snowfall, and winds and seas not greatly different.

The prevailing storms on Lake Superior are from the northeast and northwest. During the summer months the perils of navigation are mainly those of fogs and squall winds, the latter occurring almost invariably in connection with thunder storms. In the spring and the autumn the lake is stormy and dangerous.

The length of the steamer track from Point Iroquois to the entrance of Duluth harbour is 383 miles; from Michipicoten harbour, Ontario, to Duluth, in a straight line, the distance is 350 miles. The breadth of the lake (longitude 86 degrees 45 minutes) is 160 miles. According to the report of the Deep Waterways Commission, published in 1897, the area of the water surface of Lake Superior is 38,800 square miles, but according to the calculations of the Canadian Geological Bureau the total area of the water surface, as divided by the boundary line between Canada and the United States is, in the United States 20,780 square miles and in Canada 11,760 square miles, making a total of 32,630 square miles. The total area of the basin is 80,400 square miles, and the area drained is 48,600 square miles. The total land shore area is 49,370 square miles, divided as follows by the boundary line between Canada and the United States: on the Canadian side 31,730 square miles, and on the United States side 17,640 square miles. The maximum depth recorded by the United States Lake Survey officers is 1,012 feet. According to statistics furnished by the United States Weather Bureau, the average yearly rainfall on Lake Superior is 28 inches the mean surface of the lake above mean tide at New York city, during forty-five years, from 1860 to 1904, is 602·29 feet. The standard high water above mean tide at New York city is 605·32 feet; the standard low water adopted by the United States Lake Survey for the new charts, above mean tide at New York city, is 600·56 feet. The low water datum for harbour improvements above mean tide at New York city is 601·75 feet. The mean level of Lake Superior above the mean level of Lake Huron is 20·89 feet. The discharge of St. Marys river, as measured in 1902 by the United States Lake Survey officers, at the mean stage of Lake Superior (602·29) is 75,000 cubic feet per second. The increase in discharge per foot rise of the lake is 15,500 cubic feet per second. The average date of the opening of navigation at the St. Mary's Falls Canadian canal is April 27, and the average date of the closing of navigation is December 2.

During the year 1904 the monthly mean stages of the lake above mean tide at New York city were as follows:—

	Feet.
January	602·51
February	620·32
March	620·14
April	603·19
May	602·51
June	602·81
July	602·91
August	602·99
September	603·08
October	603·27
November	603·21
December	602·82

The yearly mean stage in 1904 was, therefore, 602·73 feet.

During the season of navigation of 1905, from March to October, inclusive, the mean stages of Lake Superior have been as follows:—

	Feet.
March	602·05
April	602·24
May	602·48
June	602·76
July	603·08
August	603·21
September	603·41
October	603·42

The Canadian government has established storm warning stations at Fort William, Port Arthur and Sault Ste. Marie. At Fort William it consists in a signal mast, a little to the east of the C.P.R. elevators. At Port Arthur a signal mast is to be seen on the inner end of the government wharf, and another signal mast exists on the government wharf at Sault Ste. Marie, Ontario. The United States government has established life-saving stations at the following places:— Crips, Michigan; Duluth, Minnesota; Grand Marais, Michigan; Marquette, Michigan; Musallonge Lake, Michigan, near the mouth of Sucker River, 15½ miles easterly of Grand Marais; also at Portage Lake ship canals, at Two-Hearted River and at Vermillion Point, Michigan.

Compared with others of the Great Lakes, Lake Superior was fairly well provided with natural harbours, and the works of improvement, on the Canadian side as well as on the United States side, have created additional harbours of refuge at various points. One class of improved harbours consists of bays of generally deep water, having wide mouths, or openings towards the lake, which have been provided with breakwaters to partially close the natural openings and form the desired protection.

A second class of improved harbours consists of those whose entrances are formed by parallel piers or jetties extending from the shore out across a bar of gravel or sand to the desired depth of water, the primary object being either to confine the current to a fixed and narrow width in order to scour and maintain the channel to the depth needed, or to prevent an improved channel from being filled by drifting sand.

Port Arthur affords an illustration of a dredged channel protected from waves and drifting material by a breakwater pier. In late years deeper channels have been required than could be obtained by the scouring action of the currents alone, and dredging has been resorted to. In the harbours at the mouths of rivers the enlargement of the channels by dredging has reduced the velocity of the outgoing currents and changed their action from that of scouring to that of depositing silt or coarser material, so that further dredging from time to time has become necessary. Therefore the jetty piers now serve only to protect the improved channels from the filling up which would result from the action of storm waves and of the so-called littoral currents.

Among the natural and improved harbours on the Canadian side of Lake Superior, from Gros Cap, at the head of St. Marys river to Port Arthur, there are Goulais Bay, with an average depth of nine fathoms inside and which affords good anchorage and protection from all winds; Gargantus harbour, a small harbour of refuge, about 77 miles from the head of St. Mary's river, which affords anchorage and shelter; Michipicoten harbour, on the northerly shore of Michipicoten bay, and the easterly shore of Lake Superior, which is one of the lake terminals of the Algoma Central Railway; Peninsula harbour, Nipigon bay and Thunder bay, which is a fine sheet of water extending 35 miles in a northeast and southwest direction, with a width of 15 miles northwest, narrowing at both ends. On its shores, cliffs rise from 1,000 to 1,350 feet out of the lake. The northwest coast of the bay, extending from Port Arthur to its head, may be approached within a mile.

About 25 miles opposite Thunder Cape is Isle Royal. The north shore of this island can be approached with safety within three-quarters of a mile of the general direction of the coast. Right at the mouth of Thunder bay is Pie island, about 900 feet high, eight miles long east and west by four miles wide. Good anchorage from southerly winds is to be found off the north and northwest sides, and from the northerly winds off the south side. The passage between Pie island and Thunder Cape, 5¼ miles wide, is quite clean. Thunder cape is a very prominent headland, about 800 feet high, marking the coast entrance to Thunder bay. Upon its south end is a lighthouse tower 45 feet high, exhibiting a light revolving white every minute, visible at 14 miles. A

steam fog-horn sounds blasts of five seconds every half minute. All parts of the cape may be approached to within 200 yards.

On the northwestern side of Thunder bay is Port Arthur.

14. PORT ARTHUR AND FORT WILLIAM.

Port Arthur is rendered safe by breakwaters parallel to the shore, the entrance being through a gap marked by a fixed red light, 43 feet high, upon the northern portion of the breakwater. The channel is dredged, and 19 feet may be carried to the Canadian Northern Railway Company's elevator. The inner harbour at Port Arthur is therefore formed by two cribwork breakwaters extending in front of the wharfs on the water front of the town. The more northerly breakwater is 3,654 feet long, and has a general trend south of 25 degrees west from a point outside the elevator wharf at the north end of the town. The lighthouse is on the breakwater, and is situated at 31 feet from its south end, showing, as above stated, a fixed red light 43 feet high.

The breakwaters are sunk generally in 17 and 18 feet of water, and have a height of five feet six inches above low water. On the lake side the crib work is made vertical up to about low water line, and from there to the top it is finished with a slope one in one, strongly sheeted and the angles protected by boiler plates. The construction of this breakwater has converted what was formerly a dangerous and exposed roadstead into a safe and commodious harbour.

The main entrance between the breakwater is 366 feet wide and is lighted as above noted. A red gas buoy showing a white acetylene gas light automatically occulted at short intervals, is moored in the prolongation of the dredged channel, 2,575 feet southeast by east of the breakwater light. Mariners find the best water by passing 50 to 100 feet southwest of the buoy and steering to pass the same distance off the northern breakwater, when not less than nineteen feet will be found.

There are two entrances: The western entrance, 1,800 feet in width and reported in 1899 at 12 to 18 feet deep, and the eastern entrance 250 feet wide and reported in 1899 as 17 feet deep. The depth of water in the basin was reported in 1899 as varying from 14 to 18 feet.

The Pigeon River Lumber Company have at Port Arthur a large saw mill and, besides, several new industries are developing. Port Arthur is connected with Fort William by an electric railway, and both cities have a common telephone system.

Fort William is situated five miles west of Port Arthur, on the west side of Thunder bay and at a short distance up the Kaministiquia river, described as a broad stream with firm banks and good advantages for lake traffic. Fort William is with Port Arthur the great shipping port of the Canadian northwest.

The Kaministiquia river rises in Dog lake, at an elevation of about 719 feet above Lake Superior, and flows southerly and then easterly to the lake, a distance of about 42 miles. Falls and rapids are found along its course down to a few miles above the lake. It bifurcates twice in the vicinity of Fort William and has three mouths, known as Fort William river, McKeller's river, and Mission river. Extensive dredging operations by the Canadian government have deepened and widened the channel over the bar of the mouth, and up the river to Fort William, and provided basins for the use of vessels. The nature of the river is such that sand bars are formed at the mouth each season.

The channel at Fort William is dredged and 19 feet of water may be carried into Fort William, and 16 feet may be found five miles up the river to the coal unloading plant of the Canadian Northern Railway Company.

For the purpose of extending the period of navigation a powerful tug had been employed in the fall of the year 1904 to prevent the formation of ice on

the shoals at the mouth of the river, or to break it loose if formed, and thus keep the channel open for a longer time. The material brought down by the river is fine and appears to consist of clay and light sand. The shoals extending out from the mouth on either of the channels, to the vicinity of the Welcome island, are sandy and have a very gentle slope, so that sailboats may ground half a mile from shore within hailing distance of vessels navigating the channel.

From Mutton island, which is situated a short distance north of the mouth of Mission river, to the shore the water is so shallow that it is scarcely possible for even a row-boat to pass. This shoal appears to be the direct product of the action of the waves and the final result will probably be a bar connecting the island with the shore.

Fort William harbour is well lighted.

A cylindrical gas buoy, displaying a white acetylene gas light automatically occulted at short intervals, is moored at the outer end of the northern edge of the dredged channel.

The axis of the channel is marked by two fixed red range lights. The front tower stands on the east end of the timber facing on the Canadian Pacific Railway coal yard, which forms the north shore of the river at that point, and is close to the water's edge; the light is 42 feet above water level. The rear tower stands behind the trestles and pockets of the coal plant, by which it is partially hidden from the water, and is 122 feet high and painted red. A day-mark, near top of lantern column, consists of a black square, six feet on a side with a white diamond in the middle. The light is incandescent electric, 128 feet above lake level, and is visible 12½ miles in the line of range.

The towns of Fort William and Port Arthur afford a most striking example of western progress. The population has doubled in two years. Port Arthur has now 7,000 people, and Fort William 7,500. It is predicted that within five years there will be 50,000 people within the borders of the two cities. This remarkable growth is due to the advantageous situation of Port Arthur and Fort William, and their unexcelled railway and steamship facilities. They are the gateways to the great west, the spout of the hopper from which pour millions of bushels of grain grown on the western prairies and a large proportion of which is transhipped there, to be carried down the lake to Georgian Bay points or to Cleveland, Buffalo, Kingston and Montreal. The facilities for handling this great crop at Port Arthur and Fort William are being increased from year to year. The elevator storage capacity at Fort William and Port Arthur, according to the latest figures, are as follows:—

	Bushels.
At Fort William—	
Canadian Pacific Railway Elevators, A and C	2,750,000
" " " B and E	2,500,000
" " " D	3,162,000
Total	8,412,000
The Empire Elevator Company, Ltd	1,700,000
The Ogilvie Flour Mills Company, Ltd	750,000
Total at Fort William	10,862,000
At Port Arthur—	
Canadian Northern Railway, Elevators, A	3,500,000
" " " B	3,000,000
Total	6,500,000
J. G. King & Co.'s elevators	800,000
Total at Port Arthur	7,300,000

The total amount of wheat shipped at the Canadian Pacific Railway elevators at Fort William for the year ended December 31, 1904, is 22,534,416 bushels. The total amount of wheat shipped out of the same elevators from January 1 to November 21, 1905, inclusive, is 17,511,041 bushels.

On the other hand, the Canadian Northern Railway Company, in a statement furnished December 1, 1905, states that the total storage capacity of its two elevators at Port Arthur is 7,000,000 bushels. The two working houses have a total receiving capacity of 250 cars per ten hours, and a shipping capacity into the vessels of 225,000 bushels per hour.

From the crop of 1904 the Canadian Northern Railway passed 7,024,550 bushels through its elevators, and from the crop of 1905, up to and including November 25, the company received into its elevators at Port Arthur 6,070,002 bushels.

The elevators of the Empire Elevator Company, Limited, was constructed at Fort William in 1904, and completed December 1 of the same year. The wooden working house of the elevator has a capacity of 500,000 bushels, and there is besides a fire-proof storage of a capacity of 1,250,000 bushels. The total amount of grain handled during 1904 is 5,000,000 bushels, and during 1905, up to November 30, 6,000,000 bushels.

In 1904 and in 1905 a channel was dredged by the Department of Public Works along the face of the Empire Elevator Company's new dock. When completed this channel will be 140 feet in width, and will have a depth of 22 feet below zero of the new gauge adopted in January, 1904. The channel of the River Kaministiquia from the Mission river to the Canadian Northern Railway coal dock at West Fort William has been widened and deepened in places where shoals were found. During the season of 1904, the sum of $91,508.92 was spent in this work by the Department of Public Works, and a further sum of $195,000 was appropriated for the season of 1905.

The Ogilvie Flour Mills Company, Limited, have started to erect at Fort William one of the largest flour mills in Canada, and several eastern concerns are negotiating for locations to start branch factories. It is expected that within the next few years there will be an industrial development at the head of the lakes, second to no other city in Canada.

15. THE WATER POWER AT KAKABECA FALLS.

Another factor of the development at Fort William and Port Arthur will be the availability of electric power from Kakabeca falls, which the members of the sub-committee took occasion to visit.

Kakabeca falls proper are situated about 16 miles from Fort William. For upwards of a mile above the actual falls, the river tumbles down a succession of rocky inclines, forming the Ecarte rapids, at the head of which a company composed of Montreal capitalists, has constructed the intake of its power canal.

Skirting the valley of the river on its northern bank, the Canadian Northern Railway passes within a quarter of a mile of the falls. The Power Company has been engaged during the whole summer of 1905 in the harnessing of the river as follows:—

From above the Ecarte rapids a gigantic circular flume or aqueduct is being laid at an elevation which will add another forty feet to the hundred and twenty feet of the falls, while the lower rapids, below which the turbines are being placed, will add yet another twenty feet, giving a total of no less than one hundred and eighty feet, higher than all but one of the heads of water at the power development at Niagara, and only falling short of that one by a short space that could be measured by inches. The aqueduct is a huge tube of concrete, ten feet in its inside diameter, the whole structure being strongly reinforced with hoops

of steel and bars running in a longitudinal direction, forming a network of steel of six-inch mesh, imbedded in solid concrete. The construction of this aqueduct is unique in American engineering, the only others of a somewhat similar kind being built in France, so that the successful completion of this work may prove to be an important epoch in the solution of engineering problems relating to water-power development.

From the point of intake to the outlet into the main reservoir which is on the brow of a steep ridge overlooking the site of the power house, 180 feet below, this pipe lies practically level for a distance of 7,000 feet, and after being discharged into the reservoir the water is divided and flows through two seven-foot penstocks, which run at a steep incline to the water wheels on the bank of the river

The construction of the flume will require approximately 35,000 yards of concrete, and the progress of the works has been facilitated in the most material manner by the fact that the ground through which the big pipe runs is largely made of beds of gravel of an excellent quality for the making of concrete, so that the excavation of the shallow ditch in which it lies provides at the same time an important item in the material required for the building of the conduit. At its upper end it will traverse a rocky belt, and it is estimated that 35,000 cubic yards of rock will have to be removed here and the place where the power house is under construction.

Across the Kaministiquia, just below the intake, a dam is being thrown, 20 feet in height, there being already a depth of 14 feet in the river at this point. The design of this dam is such as to admit the passage of the maximum flow of water without materially affecting the levels of the upper reaches of the river when it is in flood, while retaining enough to keep the big flume filled to its capacity even when the stream is at its lowest.

The reservoir into which the flume discharges is a massive structure of concrete and steel, from which are fed the two steel penstocks leading direct to the turbine wheels, 180 feet below. Each of these wheels will be capable of developing 7,000 horse-power, the initial development which is now under way being thus 14,000 horse-power.

The plans are, however, being prepared, and the work laid out so as to permit of this being doubled at any time by the building of a second flume and providing two additional penstocks, all the rest of the plant being capable of working to the double capacity. In fact, the present operations are intended to be merely the commencement of a water power development which will be on a very large scale, and the ultimate development may greatly exceed that here outlined, for, if the demand for power at the head of the lakes should exceed the 28,000 horse-power thus provided, there is ample reserve behind to duplicate it, and possibly to multiply this by two again.

From the power-house at its point of generation, the electric energy will be transmitted to Fort William along a copper wire, at a pressure of 25,000 volts to the sub-station now being erected in the western end of the town, and from this it will be stepped down to any voltage that may be required by consumers. This sub-station is a plain but massive building of concrete and steel, with a floor area of 5,600 square feet and a height of 40 feet.

Construction on the harnessing of the river is being pushed ahead with even greater rapidity than was anticipated, and with a force of about 700 men constantly employed through the winter, the company will have the current transmitted to Fort William by June 1, 1906. A bargain has been struck with the town of Fort William, under the terms of which the town will get 600 horse-power at a flat rate of $25 per horse-power for a 20-hour service, and the Ogilvie mills will be ready to use power by the spring of next year, the elevator of the company being now operated by electrical power provided by the town plant and generated by steam.

How great will be the effect of this power development upon the future of Fort William as a manufacturing centre for all industries that are seeking to enter the growing markets of the great West, can be readily appreciated. Raw material can be delivered on the docks of Fort William as cheaply as at any port on the lake system, while the railway haul from this point to the places of consumption is short as compared to the distance from the factories of the East, and the rapid settlement of Manitoba and the provinces of the West will, in the near future, make the West one of the most important markets for all kinds of manufactured articles in Canada.

After their visit in the harbours of Port Arthur and Fort William and the surrounding country, the members of the sub-committee went across to Duluth, leaving Fort William on Sunday evening, August 20, on board the steamship *Huronic*, of the Northwestern Navigation Company.

Arriving at Duluth the following morning, before noon, they visited the harbour of Duluth.

16. THE HARBOUR OF DULUTH.

The harbour of Duluth and the harbour of Superior are practically the same, and they include all navigable waters lying inside of Minnesota Point and along the fronts of the cities of Duluth and Superior to the city limits of each, embracing the new Duluth canal, Superior entry, Superior bay, Allouez bay, St. Louis bay, and St. Louis river as far westerly as the bounds of the city of Duluth.

Before improvement, the bays were broad expanses of shallow water with a general depth of only eight or nine feet, except along the channels, which were deeper but variable. The natural entrance to Superior bay from Lake Superior, now called Superior entry (also known as the Wisconsin entrance), was a winding channel over a shifting sand-bar, with an available depth of 9 to 11 feet, and difficult to follow.

The United States commenced the work of improvement at Superior entry in 1867, under a plan providing for building two parallel jetties across the bar and dredging a channel between them, and began operations at Duluth in 1871, under a plan providing for the extension of the breakwater commenced by the Northern Pacific Railroad just outside of the northerly end of Minnesota point. The extension was completed for a distance of about 1,000 feet from shore, but the superstructure was destroyed by storms, leaving the cribs submerged.

The Duluth canal was cut through Minnesota point by the city of Duluth in 1870 and 1871, and in 1873 its maintenance and improvement were undertaken by the United States to provide an inner harbour of easy access in place of the exterior harbour, for the formation of which the breakwater had been constructed.

The latest approved project provides for the widening and deepening of channels to a navigable depth of 20 feet, for a new channel in Allouez bay, a new channel in St. Louis bay extending northerly, and a new channel in St. Louis river; for extensive turning and anchorage basins at the junction of various channels; for widening the Duluth canal and rebuilding the piers, and for rebuilding the piers at Superior entry. The work of widening the Duluth canal and rebuilding the piers was completed in 1901. The extensive dredging contract, under which work was in progress for nearly six seasons, and which involved the removal of over 21,500,000 yards of materials, was completed November 14, 1902.

The work of rebuilding the piers at Superior entry was begun in the spring of 1903. There will be two new piers built of concrete, the south pier 2,960·5 feet, and the north pier 3,418·5 feet in length. The work in the season 1903 and 1904 was upon the westerly half of the south pier, which is located about 70 feet south of and behind the old south pier, the old pier remaining in place while

the new one is under construction. About 1,600 lineal feet of the new pier was completed at the close of the season of 1904. The operations of 1905 have been on this line and have not interfered in any way with navigation.

The new piers of the Duluth canal, completed in 1900-1, are of equal dimensions, and the clear width between them at the entrance and for a distance of about 1,250 feet from the outer end is 300 feet, after which they flare out at the harbour end to a width of about 540 feet. Each has a length of about 1,700 feet, and projects about 2,150 feet beyond the shore line.

The foundation cribs extend 22 feet below low water datum and the concrete superstructure rises from 10 to 18 feet above that plane. Riprap has been placed along the base of the piers to prevent undermining by currents. Along channel faces of north and south piers is 16 to 23 feet of water over the riprap, dropping off rapidly to greater depths except for the outer 450 feet of channel face of south pier, where there was formerly a rock embankment; this embankment has been partially removed, leaving a depth of 11 to 16 feet close to the pier, a least depth of 17 feet at 20 feet out, and 23 feet at 33 feet out from pier. The clear width of channel with 23 feet least depth is about 240 feet; depth along mid-channel is at least 25 feet.

One of the principal attractions of the harbour of Duluth is the new aerial ferry or suspended-car ferry over the Duluth canal. The truss which spans the channel has a clear height of 138 feet above low water datum, 137 feet above ordinary high water, and about 135 feet above the highest recorded stage of water in the harbour. Any vessel on the Great Lakes can freely pass under the bridge. The car, which is suspended from a trolley or truck running on the overhead track and reaching down to within about 12 feet of the water has been completed and inaugurated last summer. The car is 50 feet long and 31 feet wide, is propelled by an electric motor, which is placed under the floor of the car and turns a drum from which cables lead up to the overhead truck and then along the bridge to either tower.

The car is large enough to carry at the same time street-car, teams and foot passengers, the motor is in duplicate, and two independent sources of electric current are available, either of which can be turned on quickly in case the other fails. There is a controller at each end of the car, and the operator is stationed at the forward end of the car. The time required for crossing the channel is 1½ minutes. There is an additional and independent hand gear for propelling the car in case of failure of the electric motor. This moves the car much more slowly, and is used only for the purpose of getting the car away from the channel in case of a breakdown.

The steel bridge is 393 feet long, and the bridge supports at the ground are 78 feet wide. This aerial bridge was completed in 1904, at an expense of $100,000. It is free to the public and it has a carrying capacity of 25,000 pounds.

17. THE PROPOSED WORKS OF THE MINNESOTA CANAL AND POWER COMPANY.

During their visit to Duluth, the members of the sub-committee had several interviews with persons and companies interested in the proposed works of the Minnesota Canal and Power Company. At St. Paul and Minneapolis, parties also interested in the propsed undertaking of said company were interviewed informally and valuable information was obtained.

At the height of land in St. Louis and Lake counties, in northern Minnesota, the waters from Birch lake and White Iron lake, and the streams running out thereof, and the immense watershed thereof, run northward and ultimately into Rainy lake, and from there into Rainy river, passing into the Lake of the Woods. The water from this source forms by computation seven per cent of the water passing out of Rainy lake over Alberton falls at Koochiching. The water system of Rainy river and of Lake of the Woods have long been established as a com-

mercial highway. From the Canadian ports of Rat Portage and Fort Frances two large and well equipped passenger and freight lines ply daily during the season of navigation, forming the means of water communication between the Canadian ports of Rat Portage, Rainy River town, Boucherville, Barwick, Emo, Big Forks, Little Forks, Isherwood, Fort Frances, Bears Pass, Seine River and Mine Centre, and forming along a considerable part of such route the only vehicle of passenger and freight communication.

The most important section of the 200 miles of navigation is the Rainy river, flowing through what is rapidly becoming a thickly populated and prosperous valley for some 80 odd miles, with towns rapidly building up at close intervals on its banks, dependent almost wholly on the river route for their mercantile and manufacturing interests. The fine class of steamboats plying on this water is already, in certain portions of the summer, hampered by low water on the rapids and shoals of the river, and the proprietors of the regular steamboat lines have been earnestly petitioning for such improvement being made on the river as would remove such disability, a disability that compels the withdrawal, for considerable intervals during each summer, of some of the large and deeper draught steamboats. In view of the fact that navigation is already suffering for lack of adequate water in portions of Rainy river and in portions of Rainy lake, the population of that district has learned with surprise and alarm that active steps had been taken by the Minnesota Canal and Power Company, of Duluth, Minnesota, to obtain the authorization of the Federal government of the United States, through the Commissioner of the General Land Office at Washington, to construct a dam or dams and canal to divert all the waters of Birch lake and White Iron lake watershed, into the Embarrass river, and by it into Lake Superior at Duluth, thus diverting from this long-established international waterway of Rainy lake and Rainy river a large proportion mentioned of its tributary waters. It is claimed that, if permission be given by the Federal government of the United States to the project of the Minnesota Canal and Power Company, a disastrous injustice will be done to Canadian and American established navigation companies that are now using the water highway of Rainy lake and Rainy river, and to the manufacturing towns along the river, both on the Canadian and United States sides.

It is claimed that the waters of Birch lake and Birch river and White Iron lake help to form the chain of lakes and rivers along the boundary which are referred to in the Webster-Ashburton treaty, and which, by the terms of that treaty, are a public highway, free to the citizens and subjects of both countries. The scheme of the Minnesota Canal and Power Company is to take 600 cubic feet per second out of a total estimated average flow of 985 cubic feet per second. The minimum flow is estimated at 210 cubic feet per second. The quantity to be taken, 600 cubic feet per second, would be more than the natural flow during the greater part of the year.

The corporation of the town of Fort Frances on March 17, 1904, sent to the Minister of Marine and Fisheries of Canada a protest against the proposed undertaking of the Minnesota Canal and Power Company. This protest has been sent by the Canadian government to the United States government through the British Embassy at Washington.

On January 25, 1905, the Acting Secretary of State, F. B. Loomis, informed the Right Honourable Sir H. M. Durand, G.C.M.G., the British Ambassador at Washington, that the United States Secretary of the Interior had directed the Commissioner of the General Land Office, before whom the application of the Minnesota Canal and Power Company was pending, to suspend further action in the case until advised as to the result of the inquiry which was to be made by the International Water Boundary Commission. This clearly meant that, in the opinion of the United States government then, the case of the Minnesota Canal and Power Company was to be investigated and reported upon by

the International Waterways Commission. Later on, somewhere in the month of March, 1905, the Attorney General of the United States, called upon to give his opinion on the construction to be put upon the Act of Congress authorizing the appointment of the commission, stated in reference to the case of the St. John river, New Brunswick, that the jurisdiction of said commission was limited to the system of the Great Lakes and the St. Lawrence river.

The members of the sub-committee informed the various parties they interviewed at Duluth, and at St. Paul and Minneapolis, that the Canadian section of the commission was willing to take up the case of the Minnesota Canal and Power Company, according to instructions received by them from the Canadian government, but that the American section had expressed doubts as to whether or not they had the power to deal with it.

18. WORKS OF THE ONTARIO AND MINNESOTA POWER COMPANY, KOOCHICHING FALLS.

Since the Minnesota Canal and Power Company made this application to the United States Secretary of the Interior, the Rainy River Development Company and the Ontario and Minnesota Power Company have constructed extensive works at Koochiching falls for the purpose of improving navigation in Rainy lake and Rainy river, with the expectation of using the power which will be developed for manufacturing purposes. The Ontario and Minnesota Power Company, under a contract with the Ontario government, have acquired the Canadian end of the Koochiching falls, and a number of acres of shore land adjacent. They have obtained during the last session of Parliament an Act of incorporation, being chapter 139, and entitled 'An Act respecting the Ontario and Minnesota Power Company.'

By an Order in Council, approved by the Governor General on September 19, 1905, the Minister of Public Works and the Government of Canada have approved the plans of the Ontario and Minnesota Power Company. The engineers of the Department of Public Works stated that in so far as the construction of the dam at Koochiching Falls is concerned, it will in no way interfere with navigation above or below the fall at Fort Frances, but will, in fact, be an improvement. The dangerous rapids, two miles above Fort Frances, will be flooded, thereby improving materially the navigation. The freshet waters stored in Rainy lake could be let out, during the season of low water, thereby also considerably improving navigation of the river between Fort Frances and the Lake of the Woods. The only objection that could be raised to the proposed elevation of the dam is provided for by a proposed revetment wall to be constructed by the company, and also by a clause in the Act of incorporation of the company, which makes all damages to lands caused by their works a charge to be borne by them.

The proposed works of the Minnesota Canal and Power Company would interfere with the works authorized by His Excellency the Governor General in Council. It is expected that soon after the present session of Congress, the International Waterways Commission will take up this question.

19. THE HARBOUR OF CHICAGO.

The members of the sub-committee left St. Paul on Wednesday evening, August 23, for Chicago, in view of making a visit to the Chicago Drainage Canal, and a preliminary investigation on a question submitted to the Commission at its meetings of June 14 and 15 in Toronto, viz.: 'The effect of the diversion by the Chicago Drainage Canal of 10,000 cubic feet per second on the levels of Lakes Michigan, Huron, Erie, and Ontario and on the river St. Lawrence.

The first day of their visit to Chicago was spent in making an inspection of the harbour of Chicago and of the large improvement works constructed therein by the United States government.

As stated in the reports of the engineers of the United States War Department, the harbour of Chicago originally could be used by none but the smallest craft, and then only when temporarily deepened by scour due to freshets. Before improvement by the government, Chicago river made a sharp turn to the southward upon approaching the lake shore, to which it ran parallel for a considerable distance before emptying into the lake, being separated from the latter by a long, narrow sand spit.

The first improvement was undertaken by the government in 1833, and consisted in cutting through the sand spit at the point where the river made a sharp turn to the southward, in protecting the banks of this cut by pile pier revetments, which have been extended from time to time, and in aiding the natural scouring of the channel between the piers by dredging. In 1870, to provide a safe anchorage ground for vessels loaded for departure, but detained by gales, or for others seeking shelter at such times, also to provide facilities for relieving the overcrowded condition of the river, and to protect the wharfs and slips proposed to be constructed along the lake front between Randolph and Twelfth streets, the easterly breakwater was projected, and later the southerly breakwater. In 1878, to facilitate entrance to the harbour, and to provide a sheltered anchorage ground in deep water during severe northerly storms, the exterior breakwater was proposed. The works of improvement, include dredging harbour entrance and a portion of basin to a depth of from 21·8 to 22·8 feet; improving the piers at the mouth of the Chicago river, and extending the easterly, southerly and exterior breakwaters.

The exterior breakwater is about a mile northeast of the entrance to the river; it is 5,413 feet long, 30 feet wide, and was constructed between 1880 and 1889 in water varying from 18 to 32 feet in depth. It has proved a decided benefit to navigation. The harbour of refuge between this breakwater and the entrance to the river has a depth of 18 to 32 feet. The easterly breakwater is about 4,037 feet long, with a shore return at the north end 300 feet long. The southerly breakwater begins about 750 feet south of the southerly end of the easterly breakwater, and is about 3,000 feet long. The easterly and southerly breakwaters, with the south pier to the north and the shore to the west, form the outer basin. The construction of the proposed wharfs and slips along the lake shore from Randolph street to Twelfth street, having been delayed from year to year by the lake from litigation, and finally abandoned, and a bulkhead was built in 1896 along the dock line established by the Secretary of War in August, 1871, and September, 1890; the area west of the bulkhead has been designated as a public park and is being gradually filled in, thereby reducing the area of the basin to 270 acres. Its length is about 7,300 feet, and its greatest width is about 2,000 feet. The basin for 1,150 feet width along easterly breakwater and 3,000 feet length southward from south pier, has been dredged to 32·8 feet depth. The undredged portion of the basin is very irregular in depth, varying from 12 to 20 feet at low water.

Chicago is divided into three sections by the Chicago river with its two branches. This river is a mile long and presents a busy appearance with vessels docked all along its banks.

20. THE CHICAGO DRAINAGE CANAL.

One of the interesting features of Chicago is the Drainage canal, which unites the Chicago river and the Mississippi river system, and saves the lake from being polluted by the drainage of Chicago's sewerage system. This canal has already cost $34,000,000 and probably an other sum of $30,000,000 will be required to complete it.

The following dimensions of the Drainage canal are furnished by the officer in charge: Distance from mouth of Chicago river to junction of main channel of canal, with the west fork of south branch of Chicago river at Robert street, about six miles. Length of main channel, Robey street to controlling works at Lockport, 28·05 miles. Dimensions: Robey street to Summit, 7·8 miles, 110 feet wide at bottom, 198 feet wide at water line, with minimum depth of water, 22 feet; Summit to Willow Springs, 5·3 miles, 202 feet wide at bottom, 290 feet wide at water line, with 22 feet depth of water; at Willow Springs the channel narrows to the walled bottom, 162 rock cross-section, extending 14·95 miles to Lockport, 160 feet wide at bottom, 162 feet wide at top. This canal is not yet entirely completed. It was designed to take up eventually a volume of 10,000 cubic feet per second, about five per cent of the flow over Niagara Falls, which is about 222,400 cubic feet per second. The Chicago Drainage canal, when completed, will, according to a calculation furnished by Mr. Louis Coste the engineer of the Canadian section of the commission, lower the level of Lake Huron by six inches and the level of Lake Erie by four and a half inches.

The diversion from waters of Lake Michigan by the drainage canal had its origin in the sanitary needs of the city of Chicago.

Chicago was incorporated in 1837 with a population of about four thousand. When the great fire of 1871 swept the city, the population was about three hundred and twenty-five thousand. To-day, nearly thirty-five years after the fire the population has reached two million. The source of water supply for the city of Chicago is and has been since its inception Lake Michigan. For a long term of years that great reservoir was also the receiver of the sewage of the city. This could not last for ever, and Chicago was confronted with the urgent necessity of disposing of her sewage in a manner that would prevent contamination of her water supply.

Two sluggish streams, the North branch and the South branch of the Chicago river flow through the city approximately parallel to the shore of Lake Michigan, to the main river which—since the diversion—flows *westward* from lake Michigan. For many years, the sewage of the city was discharged into these streams, and, at least as early as 1860, the offensive condition of the South branch attracted official attention. The first complaints arose, not on account of contamination of the water supply, but on account of the offensive odour. In 1862, high water in the river, and lowering of the lake level by wind, resulted in arousing complaints respecting the foul smell and taste of the water supply.

In 1871, the situation was partly relieved by cutting down the summit level of the Illinois and Michigan canal—connecting the Chicago and Desplaines rivers—and drawing the water for the canal from Lake Michigan. Later it was found necessary to install pumping machinery, at Bridgeport, to maintain a current westward through the South branch and the Illinois and Michigan canal. In 1874-80, another pumping plant was constructed to pump water from the lake, through the Fullerton Avenue conduit, into the upper waters of the North branch.

In 1880, after twenty-five years of struggling to get rid of her sewage and prevent contamination of her water supply, Chicago was still looking for some means of purifying the river from its filth, and preventing a repetition of the great epidemics of 1848 and 1854, which had led to the construction of the first system of sewers.

To meet these conditions, Chicago, in 1889, decided to adopt an extensive sewage scheme, employing what is known as the dilution method. This method was selected because it was believed that, if sufficient water could be readily and cheaply obtained, it would be an economical one for Chicago. The dilution method consists essentially of diluting sewage effluent with sufficient

water to render it inoffensive. In the case of the Sanitary District of Chicago, this proportion has been established by a State law which fixes it at one cubic foot of water per second for each 300 of population. On this basis, a population of 3,000,000 would require 10,000 cubic feet per second.

A corporation, known as the Sanitary District of Chicago, was formed under a special Act of the State of Illinois, and empowered to undertake the construction and operation of the works necessary for the new projects. The enabling Act, entitled 'An Act to create sanitary districts and to remove obstructions in the Desplaines and Illinois rivers,' was passed May 29, 1889, and came in force July 1 of the same year. The Sanitary District comprises an area of 358 square miles.

The board of trustees created by the Act of 1889 commenced the work on September 3, 1892. The main drainage channel is now completed from its confluence with the South branch of the Chicago river at Roby street in the city of Chicago to Lockport, in Will county, Illinois, a distance of 28 miles.

Water from Lake Michigan was let into the main channel via the Chicago river and through the auxiliary channel which connects the main channel with the West Fork of the South branch on January 2, 1900. It took 13 days to fill the channel from Western avenue to the controlling works. On the morning of the 17th of January 1900, the Bear Trap dam at the south end of the channel was lowered, and the waters of Lake Michigan began to flow southward.

The canal was not built only for sanitary purposes. It was evidently proposed, in connection with it, to construct a navigable waterway from Chicago by way of the Mississippi Valley to the Gulf of Mexico. In fact, the work performed from 1892 to 1904 by the Sanitary District constitutes nearly two-thirds of the entire cost of creating a channel from Chicago to Mississippi which would be navigable for the largest boats which will be able to ply between St. Louis and New Orleans after the present plans for the improvement of the Mississippi will have been completed.

Besides the creation of such a channel, which seems to have been thought of at the very start by the trustees of the Sanitary District, it goes without saying that a large amount of power can be developed from the waters diverted by the drainage canal and along the course of the proposed navigation route. The development and sale of this power will eventually create a large revenue, and no doubt in connection with this the Sanitary District and the city of Chicago, as a whole, entertain the hope that profits derived from the sale of hydro-electric energy developed by means of waters diverted through the canal may meet the whole expenditure incurred on the big undertaking which has been faced up to the present time by taxation upon the Chicago people.

The United States Congress, which has jurisdiction upon navigation matters, has not as yet finally approved the work of the Sanitary District of Chicago. But the Secretary of War has granted them some revocable permits to divert from Lake Michigan no more than 4,166 cubic feet per second.

This important question, in view of the effect that the canal may have upon the levels of the lakes, has occupied the attention of the Canadian government from time to time.

The law creating the Sanitary District of Chicago was passed by the State Legislature of Illinois in 1889, but the work of constructing the canal actually started only in September, 1892. During the summer of 1895, the Honourable John Costigan, then Minister of Marine and Fisheries, requested Mr. J. L. P. O'Hanly, a civil engineer of repute, to proceed to Chicago, examine the plans of the proposed undertaking, and to report upon them.

Mr. O'Hanly presented a report, dated February 29, 1896, stating generally that the canal would affect the levels of the lakes east of Lake Michigan. Mr. J. L. P. O'Hanly's report, reprinted with the report of the sub-committee is appended marked 'a.'

21. LAKE MICHIGAN.

The city of Chicago has a frontage of thirty miles along the shore of Lake Michigan, which is the only one out of the five great lakes having its entire shores in United States territory.

The area of the water surface of Lake Michigan is 22,400 square miles: its drained area is 45,700 square miles, and the total area of its basin is 68,100 square miles. The average annual rainfall on Lake Michigan is 33 inches. The maximum depth recorded by the United States Lake Survey officers is 870 feet. The steamer track on the lake from Chicago to the Strait of Mackinac is 321 miles. The mean surface of the lake above mean tide at New York city during 45 years (1860-1904) is 581·35 feet. The standard high water (of 1858) above mean tide at New York city is 584·69 feet, and the standard low water above mean tide at New York city is 578·51. The mean surface of Lake Michigan below the mean surface of Lake Superior is 20·94 feet. The average date of opening of navigation at the Strait of Mackinac is the 17th of April, and the average date of closing of navigation at the same place is January 9.

The following list gives the monthly mean stages of the lake, above mean tide at New York city, during the year 1904:—

January	579·90 feet.
February	579·86 "
March	580·14 "
April	580·59 "
May	580·95 "
June	580·34 "
July	581·38 "
August	581·23 "
September	581·19 "
October	581·05 "
November	580·75 "
December	580·37 "

The yearly mean stage in 1904 was 580·65 feet.

During the season of navigation of 1905 the monthly mean stages of Lake Michigan have been as follows:—

March	580·31 feet.
April	580·60 "
May	581·03 "
June	581·36 "
July	581·49 "
August	581·46 "
September	581·40 "
October	580·94 "

Lake Michigan is navigable in winter. This navigation is of importance and is increasing.

At the present time there are the following regular winter lines of steamers:—

Two lines from Milwaukee to Racine and Chicago.
One line from Milwaukee to Sturgeon Bay canal and intermediate ports.
One line from Milwaukee to Grand Haven.
One line from Milwaukee to Ludington.
One line from Manitowac to Ludington.
One line from Manitowac and Kewaunee to Frankfort.
One line from Frankfort to Manistique.
One line from Northport to Manistique.

Efforts have been made to maintain a regular winter line from Frankfort to Menominee via Sturgeon Bay canal or 'Death's Door,' but as yet they have not proved successful.

21. DETROIT RIVER AND LIMEKILN CROSSING.

The members of the sub-committee left Chicago on Saturday, August 26, for Detroit, so as to make an inspection of the Detroit river, which unites Lake St. Clair to Lake Erie.

After a visit to the office of the United States Lake Survey, in the Campau Building, where valuable information and important documents bearing on the work entrusted to the commission were obtained, a trip down the Detroit river was undertaken.

The Detroit river has two characteristic sections, the upper or undivided portion and the lower or divided portion. The upper or undivided portion runs from Lake St. Clair to the head of Fighting island, a distance, by steamer track, of 13 miles. At this point the river is divided by islands into several channels, which do not reunite at the mouth of the river. The distance from the head of Fighting island to Bar Point Shoal lightship by steamer track is 15 1-4 miles, making the total distance from Lake St. Clair to Lake Erie 28 1-4 miles.

The discharge through the upper or undivided portion of the river is 208,600 feet per second when Lake Erie is at a stage of 572·61 feet above mean tide at New York. The increase of the discharge per foot rise of the lake is approximately 21,000 cubic feet per second.

Throughout the upper portion of the river the mean current velocity is about 1 1-2 miles per hour; but at Limekiln crossing, near the mouth of the river, the mean velocity is about 2 1-2 miles per hour, with a maximum velocity of about five miles per hour. For the northerly 16 miles, the river bottom is of earth and the channel banks are usually quite steep, but at the southerly portion the river bottom consists mainly of bed rock and boulders, and the channel banks usually are more sloping. In the upper portion of the river there are two islands—Isle aux Peches and Belle Isle; there is deep water on each side of islands.

Originally the channel at Limekiln crossing could not be depended on for more than 13 feet of water, the ordinary depth being much affected by the direction of the wind. It was in 1874 that the United States government started work of improvement at this point, and they consisted of a curved channel of 300 feet wide, with a uniform depth of 20 feet. In 1883 it was determined to modify the project so as to secure a straight channel, the least width of which should be 300 feet with a somewhat greater width at either end. In 1886 this was further modified so as to increase the width to 400 feet by removing an additional 100 feet from the western side. In 1888 a further additional width of 40 feet on the western side was authorized. This 440 foot channel was completed during the fiscal year ended June 30, 1891. The estimated cost of a 400 foot channel was $1,374,500. The total amount expended up to June 30, 1891, was $702,122.04 for a channel of 440 feet.

In 1899 the United States Congress made provisions in the River and Harbour Act for a channel of 21 feet deep from Detroit to Lake Erie. The distance from Detroit to deep water in Lake Erie is about 24 miles, but the section of the river which required any considerable improvement to secure a safe and convenient channel 21 feet deep, was from near the upper end of Grosse Isle to the Detroit River lighthouse in Lake Erie. All improvements made up to 1900 have been confined to this section of the river. The improved channel passed east of Grosse island, Bois Blanc island and was in Canadian waters according to the international boundary line established by the treaty of August 9, 1842. That channel was not a convenient one for the enormous commerce coming through it. The United States War Department decided to make further improvements, and in the River and Harbour Act of June 13, 1902, the works now in way of construction were authorized. The plan was to continue operations in the channel then under improvement, so as to complete it with a low water depth of 21 feet and a minimum width of 600 feet, the side line of excavation being so located as to make the channel as straight as practicable, and especially to eliminate the dangerous bends between the head of Limekiln crossing and Bois Blanc island. The width of the channel, when completed, will be 800 feet opposite Bar point, and will be continued at that width out into Lake Erie. The cost of this excavation was at first estimated to be from $1,750,000 to $2,000,000, but the final estimate exceeds the original approximate estimate by nearly $2,000,000.

During the season of navigation of 1905 the Ballards Reef channel had a clear depth of 21 feet and a width of 600 feet. At Limekiln crossing, the width of the channel available to navigation was 420 feet, with a least depth of 19 feet. In the Bois Blanc Range channel there was a clear depth of 20 feet and a width of 600 feet. The Amherstburg Beach channel has also a clear depth of 20 feet, but it is only 250 feet wide. The Hackett Range channel has a least depth of 19 feet, with a width of 500 feet for the greater part of its length. During the season of 1905 the west half of the channel was partly obstructed by improvements in progress. The Bay Point shoal channel extends to the Detroit River lighthouse and is 800 feet wide, with a depth of 20 feet.

The United States government has proceeded with the improvement of the Detroit river without reference to the international boundary line between the United States and Canada, and this since 1874 to the present time. In 1892 and 1893 there were negotiations between the government of Canada and the government of the United States in regard to the improvement made by the United States engineers at the Limekiln crossing. Mr. W. J. Thompson, C.E., made, under the direction of the Minister of Railways and Canals, a report on the subject, and pointed out that the maps of the Commissioners appointed under the treaty of Ghent (1814) place the improved channel at the Limekiln crossing exclusively in Canadian waters. This view, however, was not adopted by the Chief of Engineers of the United States Army, who, in a report dated November 14, 1888, had already stated that 'all the channels opened by the United States at the Limekiln crossing were in American waters, except the extreme northeast and southeast corners of the cut'. By article VII. of the treaty of 1842, it was provided as follows:—

'It is further agreed that the channels in the River St. Lawrence on both sides of the Long Sault islands and of Barnhardt's island, the channel in the River Detroit on both sides of the island of Bois Blanc, and between that island and both the American and Canadian shores, and all the several channels and passages between the various islands lying near the junction of the River St. Clair, with the lake of that name, shall be equally free and open for the ships, vessels and boats of both parties.' This provision, while disposing, by the concession of mutual rights in the channels, of the difficulties of boundary at the islands named, does not affect the boundary line south of those islands, nor does it affect the Limekiln crossing, which lies north of them. This is the view taken

by the Canadian government in 1893, when the United States government made application to be allowed to proceed with the improvement of the Limekiln crossing in Canadian waters. The government of Canada in 1875 had itself assisted to the extent of $5,000 in the works of improving the navigation of Detroit river, and on August 8, 1893, the Governor General in Council gave authority to the United States to proceed with the work of removing obstructions in the river, irrespective of the boundary line, such authority to be understood expressly as being given without prejudice to the possessory rights of Canada as defined by the maps and declarations of the Commissioners under the treaty of Ghent. This makes of the Limekiln crossing a channel common to both countries.

In concluding, it might be interesting to give a comparison between the freight traffic of the Detroit river, the Soo and Welland canals.

In regard to the traffic of the Detroit river, it may be said it has been comparatively measured, for the first time, during the past season of navigation. The compilation of the figures is founded on reports of masters of vessels, which are filed with the United States Department of Commerce and Labour through its Bureau of Statistics, and it covers the season of lake navigation of the calendar year 1905. The results are shown as follows:—

Month.	South. Net Tons.	North. Net Tons.	Total. Net Tons.
April	1,575,877	792,711	2,368,588
May	4,551,972	1,352,524	5,904,496
June	5,523,021	1,780,541	7,303,562
July	5,911,625	1,941,534	7,853,159
August	6,300,003	2,314,810	8,614,813
September	4,597,640	1,493,059	6,090,699
October	5,582,689	1,522,905	7,105,594
November	4,593,752	1,578,375	6,172,127
December	1,354,506	871,542	2,226,048
	39,991,085	13,648,001	53,639,086

The south-bound movement is nearly three times as great as that in the opposite direction. This is largely due to the enormous east-bound tonnage of iron ore from upper lake ports to ports along the southern shore of Lake Erie, whence it is shipped by rail to the great iron and steel districts of southern Pennsylvania. The freight carried in a southerly direction through Detroit river during the past season of lake navigation is divided as follows:—

	Tons.
Flour	3,176,928
Ore and minerals, exclusive of coal, of which there was no south-bound movement	32,900,685
Lumber	1,851,324
Unclassified freight	971,151

The north-bound movement is divided as follows:—

Coal	11,928,158
Grain and flax seed	6,178
Ore and minerals	415,533
Lumber	11,940
Unclassified freight	1,286,192

The traffic through the Soo canals, which connect Lake Superior with the other great lakes, and through the Welland canal, which performs the same duty for Lake Ontario, has largely increased during the past season of navigation. Here follows a statement showing the traffic through the canals at Sault Ste. Marie, for the years 1896 to 1905, inclusive:—

Season.	South. Net Tons.	North. Net Tons.	Total. Net Tons.
1896	.....	.....	16,239,061
1897	.....	.....	18,982,755
1898	.....	.....	21,234,664
1899	20,619,534	4,636,276	25,255,810
1900	20,532,493	5,110,580	25,643,075
1901	23,087,742	5,315,323	28,403,065
1902	30,275,989	5,685,157	35,961,146
1903	26,932,238	7,742,199	34,674,437
1904	24,213,902	7,332,204	31,546,106
1905	36,778,738	7,491,942	44,270,680

During the season of lake navigation of the calendar year 1905, the total freight movement through the United States canal amounted to 38,802,190 tons, while that through the Canadian canal totalled 5,468,490 tons.

It will be seen that, during the lake season of 1905, the difference between the amount of freight carried, respectively, through the Detroit river and the two Soo canals is 9,368,406 tons in favour of the former. This may be said to represent, at least with a fair degree of accuracy, the traffic through the Straits of Mackinac, which consists largely of shipments of grain and flour from Chicago and iron ore from Escanaba, while the west bound cargoes consist largely of coal and package freight.

The following table represents the volume of traffic between Lake Erie and Lake Ontario by way of the Canadian Welland canal, which runs parallel with the Niagara river:—

Season.	Down tons.	Up tons.	Total tons.
1894	745,942	243,592	989,534
1895	621,926	230,100	852,026
1896	957,928	285,667	1,243,595
1897	1,026,458	218,292	1,244,750
1898	902,590	218,211	1,120,730
1899	622,104	147,514	769,618
1900	579,312	109,245	688,557
1901	501,935	89,311	591,236
1902	567,286	78,811	646,097
1903	715,595	263,212	979,807
1904	620,078	182,402	802,480
1905	848,007	227,961	1,075,968

Respectfully submitted,

(signed) THOMAS COTE,
Secretary.

Ottawa, December 1, 1905.

APPENDIX 'a.'

AD INTERIM REPORT ON THE EFFECT OF THE CHICAGO DRAINAGE CANAL ON THE LEVELS OF THE GREAT LAKES.

HON. JOHN COSTIGAN,

Minister of Marine and Fisheries,

Ottawa.

SIR,—I beg leave to report as follows:—

NARRATIVE.

When you did me the honour of communicating your intention of instituting an official inquiry into the probable effects of the Chicago Drainage Channel on the levels of the Great Lakes and their connecting rivers, you were good enough to ask my opinion as to the cost of the undertaking.

I informed you that the cost of such an investigation as you contemplated depended largely, if not wholly, on the scope of the inquiry. Were it, in character original, the process would be slow, and necessarily involve considerable outlay, as there are no Canadian or English data on which to draw. In illustration, I instanced the costly and tedious survey of the Great Lakes by the Government of the United States. This survey was commenced in 1841, and completed in 1882, with some partial resurveys since. It has cost over three million dollars. The survey comprised the River St. Lawrence from the international boundary at St. Regis westward, Lake Ontario, the Niagara river, Lake Erie, the Detroit river, the St. Clair Flats, Lake and River St. Clair, Lakes Huron and Michigan, St. Marys river and Lake Superior, not including Georgian bay.

If, on the other hand, it were considered advisable to utilize the operations and researches of the American Government in the survey of the Great Lakes and kindred inquiries, I said that I thought it highly probable that the necessary data are available, and only require examination, collation, selection, and digestion; and that I considered the proposed investigation would require very little, if any, field operations.

I respectfully submitted that, in my humble opinion, the best, the most feasible, the most expeditious, the most economical policy, was to utilize the American data, which I believe to be thoroughly reliable. In this opinion, you were good enough after due and careful deliberation to acquiesce; and to direct that the inquiry be conducted on these lines.

Accordingly, on August 19, 1895, I began operations. I examined the engineering and kindred records of the Department of Marine and Fisheries, kindly placed at my disposal by the officer in charge of that important branch of the public service. My researches here embraced: (1) An examination of the charts of the Great Lakes and connecting rivers, published at Washington under direction of the Chief of Engineers, United States Army, with memoranda. (2) A perusal of such of the annual reports of the United States Coast and Geodetic Survey. as came within my purview, with notes.

Having exhausted all the known and available sources of information in this field, I transferred my operations to a new and more fertile one—the Library of Parliament. I examined all the annual reports of the Chief Engineers of the United States Army contained in that institution, numbering over one hundred large volumes, and taking copious notes, as well as many congressional and other public documents of the United States Government, with elaborate memoranda.

It will readily be appreciated how slow and tedious is this process. It is like the proverbial ' looking for a needle in a bundle of straw.' After having perused and examined many voluminous documents, books and records, it often turns out they contain nothing to the purpose. One is also circumscribed by the rules of a public institution, and must conform to its hours and regulations. Indeed, one always labours under very great disadvantages under such circumstances; and the result seldom seems commensurate with the time occupied. The officers of the library, from the librarian down, were most kind, courteous and obliging, and evinced a cordial disposition to render every assistance in their power. Without making invidious distinctions, I am especially indebted to Mr. Smith for much useful information and other valuable services.

My search in the library justified and confirmed my first impression. I found that the records of the Corps of Engineers of the United States Army contained all or nearly all the data, as well as the only extant data, for the determination of this unique and important problem. While thus engaged, I learned, through the press, for the first time, that the United States Government had appointed a Board of Engineers to report on the very subject with which I was dealing, and that the Board had concluded its labours and submitted its report to the Chief of Engineers. This, I think, was towards the end of September.

I was hoping that this report would forthwith be published, and anxiously awaited its receipt in the library. Weary of waiting, I applied to Hon. J. B. Riley, American Consul General, Ottawa, to use his good offices in procuring me a copy from Washington. Mr. Riley very kindly wrote to the Chief of Engineers, General William P. Craighill, Washington, D.C., to send a copy, if published. To this, General Craighill, replied that the report remained yet unpublished, but that, with the permission of the Chief of Engineers, it had been printed in the New York *Engineering News*, of October 3, 1895. Through a local news agency, I secured a copy of that issue. I wish here to signify and acknowledge my deep obligations to Mr. Riley for this and many other favours in connection with this service.

A copy of the report is herewith annexed, marked Appendix A.

Perhaps there was no man living more conversant with the scientific history —the Physics and Hydraulics of the Great Lakes—than the President of the Board, the late General Poe. He was connected with the Lake Survey, almost from its inception, continuously to the day of his lamented death. Since 1882 he was chief of the Northern Division. It has been under his efficient supervision that all the great improvements to the navigation of the Great Lakes from Duluth to Buffalo, now drawing to a successful close, took place.

The Board puts this question: 'What is the outflow of the lower lakes?' To which they make the subjoined reply:

' In November, 1891, the Chief of Enginers, U.S.A., * * * ordered a set of observations made to determine the amount of water flowing down the Niagara river * * *

'The results of these measurements were somewhat unexpected, and they were repeated in May, 1892. The second set corroborated the first, and the whole formed a subject of a report to the Chief of Engineers, which appeared in his annual report of 1893. * * This publication was the first ever made in which, as a matter of careful measurements, a relation between the level of the lakes and their outflow, or discharge, had been established and given to the public.'

Continues the report. 'Will the loss be six inches, or will it be three inches? This is an important question, and we have only the Niagara River discharge observations from which to answer it. These cover a range of about 1·8 feet. There were scattering observations outside these limits, but the mass of results were secured between gauge readings, mean lake level, the highest, and 1·85

feet. The "smooth curve" * * enables us to note the fall of 0·53 feet on the gauge per 10,000 cubic feet per second for the first foot of fall, and 0·44 feet for the whole.

'* * * This lower portion of the gauge should be studied and additional observations made, and the Board is a unit in suggesting the importance of a series of gaugings of the St. Clair river at the present time for this purpose, and to furnish additional knowledge of the relation between gauge readings and discharge. The subject is of such general bearing upon the navigation of the lakes that it demands careful treatment and full data. * *

'The abstraction of 10,000 cubic feet of water per second from Lake Michigan will lower the levels of all the lakes of the system except Lake Superior, and reduce the navigable capacities of all harbours and shallows throughout the system to an extent that may be determined, if at all, by actual measurement only.'

The Board of Engineers are unanimously of opinion that the Niagara River discharge measurements of 1891 and 1892 are the only reliable and trustworthy gaugings hitherto made of the outflow of the Great Lakes, and they unhesitatingly concur that it is wholly inadequate to determine the effect of the Chicago Drainage Channel on the levels of the lakes and their connecting waterways. They recommend that these be supplemented with a series of discharge measurements of the St. Clair river, as indispensable to determine this unique and intricate hydraulic problem.

I have since learnt, through the courtesy of the Chief of Engineers, United States Army, and politeness of Col. A. Mackenzie, Corps of Engineers, that nothing has yet been done towards carrying out the recommendation of the Board of Engineers. Nor is any intimation vouched of what is intended.

A copy of Col. Mackenzie's letter will be found in Appendix B, accompanying this report.

It is obvious that if the data be considered insufficient for the uses of the American government, it is so likewise for those of the Canadian. It therefore remains for the department to determine what course to pursue in prosecuting the inquiry to a successful issue. May I be permitted to interject an opinion, I would respectfully suggest that a gauging party be organized, under a competent head, with the opening of spring, to make discharge measurements of the St. Clair river at some suitable point between Sarnia and Mooretown, to be continued until the close of the season, in order to make measurements at all stages of the river during the season of navigation. This operation might either be carried on independently or in conjunction with the United States party.

LEVELS OF THE GREAT LAKES.

The cheapest and most expeditious way of making a pond is to follow the example of the beaver—dam a living stream. Given certain conditions—slope or declivity of stream and average cross section of valley—and the volume of impounded water will depend on the height of the dam. But this height has its limits. The elevation of the crest of the dam must not exceed the elevation of the summit of the lowest depression in the drainage basin above the site of the dam. For the water on exceeding this height would be diverted to a new route, flow in a new bed or channel, at least during the lifetime of the dam, or while its crest remained at its present elevation. A case may be readily conceived in which the water would flow diametrically opposite to its original or normal course.

The volume of water discharged over the dam depends on the length of the weir, the elevation of its abutments above the crest, and the depth of water on the crest. In a normal condition of flow, with the pond in a state of equilibrium, that is to say, the water quiescent, its surface neither rising nor falling,

the discharge over the weir would equal the entire inflow from the drainage area above the dam, *minus* evaporation. This normal condition of flow or state of equilibrium is generally designated mean level of the pond.

Evaporation is the source of rain, and precipitation of supplies of water. The unabsorbed percentage of the rain falling on the drainage basin, above the dam, constitutes its influx or supply. The precipitation being an uncertain and variable *quantum*, the pond is rarely or never in a state of equilibrium. Its fluctuations aptly resemble the oscillations of a pendulum—ever tending towards the vertical, but never, except for an infinitesimal instant, remaining there. In a wet season the precipitation is excessive. The supply being augmented, the level of the pond rises, and may sometimes overflow its banks. It is a well-known law of hydraulics that the discharge varies with the head of pressure. If at a certain head there is a fixed or determinate discharge over a weir, drowned or not, then if you wish to increase the discharge you must increase the head. On the contrary, in a dry season, the supply is stinted, diminished, and the level of the pond, in obedience to the above law, falls. Any deterioration of the dam, either by erosion and lowering of its crest or by filtration through its crevices, depresses the level of the pond. There is still another way by which the surface of the water in the pond may be lowered to any conceivable extent, viz.: by digging an open ditch or tunnel, diverting all or any assignable part of its waters in an artificial channel, the quantity diverted depending on the slope and dimensions of the new conduit.

Suppose that our weir is 200 feet long, with a depth of 6 inches of water immediately behind the crest of the dam, designed to discharge, in a mean or normal stage of supply, 100 cubic feet per second. The phenomenon of discharge consists in this: That every particle of water entering at the inlet forces out an equal particle, bulk for bulk or weight for weight, at the outlet. The water itself is inert. It derives its force from the acceleration of gravity imparted to the particle at the inlet. It acts as a lever to push forward the inert mass between it and the outlet, indifferently whether the intervening mass is in a solid or fluid state. It may aptly be compared to a solid, say, a sheet of metal 200 feet wide, 6 inches deep, and continuously extending from inlet to outlet, floating on the quiescent fluid beneath. Any compressive force applied at the upper end will push out the sheet at the outlet end. Nor would it alter the principle of action if the body of water on which this sheet floats were converted into a solid. For all the liquid below a horizontal plane tangent to the crescent of the dam is quiescent or motionless, unless disturbed or agitated by extraneous causes, as winds, earthquakes and other seismic vibrations, the screw or paddles of a steamboat, &c., &c. This motion is called a motion of translation, and is such that any one particle has an equal and parallel motion with every other particle of the body. It is characteristic of the motion of a solid in a rectilineal direction.

Now every lake, great and small, is in the condition of our pond. The barrier or obstruction at its outlet is a submerged dam, resembling our weir, with banks for abutments, on whose elevation, slope and dimensions chiefly depends the permanent elevation of the surface of the water, or 'mean lake level,' as it is called. Had there been no obstruction at the outlet, there would have been no lake. The laws governing these phenomena are precisely the same, whether the dam was erected by human hands, fashioned out in nature's laboratory, or contrived by the ingenious persevering beaver.

HYDRAULICS.

The science of hydraulics is pre-eminently inductive or experimental. It is very unsafe to predicate a formula on any of the observed phenomena of flowing water until verified by experiment. This arises from no analytic defect

in the demonstration, but because the conditions of any two cases are seldom or never exactly alike. We can compute theoretically, within reasonable limits of accuracy, the discharge over a weir, or through a regular channel, as a canal, with given slope and dimensions. But when it comes to gauging a large river like the St. Lawrence or any of the connecting links in the great system of our inland seas, hydraulic formulæ lose their magic, and theory and speculation have to step aside and make way for experiment. Even with modern improvements in methods and instruments, discharge measurements are not only a delicate operation, but are still hemmed round with much uncertainty.

Much as are discharge computations surrounded, if not involved in mystery, they are simplicity itself compared to any approximate, much less exact, determination in advance of the effect of the Chicago Drainage Channel on the levels of the Great Lakes. It is obvious to the plainest understanding that the surface of the lakes must, to some extent, be lowered by the opening of the new outlet, or more properly, perhaps, ancient outlet, resuscitated, at Chicago. The project in theory contemplates an ultimate draught on the reservoir of 10,000 cubic feet per second at the lowest stage of Lake Michigan. With the known fluctuations of the lake, this will often exceed 15,000 cubic feet per second. To believe that this will not prejudicially affect the levels of all the lakes, except Lake Superior, as well as all their connecting waterways and outlet, would be equivalent to believing an absurdity. The commonest understanding has no difficulty in believing and appreciating this, the greatest intellect cannot soar much higher, come much nearer to a solution.

The problem is as complex and intricate as unique. No hydraulic formula is applicable to it, for the simple reason that no such contingency has hitherto arisen, or is likely to ever again arise. It is beset with extraneous, disturbing elements, impossible of elimination, as to be practically indeterminate by any known hydraulic formulæ. Among these are storms, changes of barometric pressure, changes in rainfall and in the percentage of the precipitation absorbed, &c., &c., &c. It is recorded that in the storm on Lake Erie of October 14, 1893, there was a difference of elevation on nearly twelve feet between the western and eastern ends of the lake. That is to say, at Toledo the water fell 6 feet 8 inches below the then normal level of the lake, while at Buffalo the water rose 5 feet 3 inches, or a total difference of elevation of 11 feet 11 inches, between these two places. (See accompanying Plate No. 4, copied from the annual report of the Chief of Engineers, United States Army, for 1894.)

An idea of the complexity of the problem may be gleaned from the following assumption: Suppose that nature, in her inscrutable ways, instead of inspiring her pigmy offspring with the conception of the construction of an artificial channel from Lake Michigan to the Mississippi river, capable of discharging, at the lowest stage of lake level, not less than 10,000 cubic feet of water per second, augmenting with the increased head of pressure to a probable discharge at mean lake level of 15,000 cubic feet, and a maximum discharge at highest lake level of 17,000 cubic feet; had, in her own laboratory, fashioned and chiselled out a subterranean passage of equal capacity with the proposed Chicago drainage ditch, fitting the outlet with automatic valves and sluices to regulate the outflow in such manner that like discharges would take place under similar heads of pressure. With present knowledge of the physics and hydraulics of the Great Lakes, it would, perchance, take a century of minute, elaborate scientific research to determine whether one gallon of Lake Michigan's waters had escaped by other than the normal or natural processes—discharge through the Straits of Mackinac into Lake Huron, and absorption into the atmosphere through evaporation. It is not improbable that at the close of the century's investigations, science would retire baffled, discomfited in the contest with nature, the mystery still unsolved, that the loss would be still masked, eclipsed, concealed from human

ken, unless disclosed by accident, while the fact remained that Lake Michigan was bled during every second of that century to the tune of 12,500 cubic feet, with the doctors still diagnosing the patient. The discharge would aggregate to the enormous quantity of nearly forty trillions (39,446,161,250,000) cubic feet, a quantity too vast to be comprehensible to the most trained intellect. Some tangible idea of its vastness may be presented to the mind by clothing it in the concrete form of a mass of water occupying a hollow prism or parallelepipedon, 283 miles long, 50 miles wide and 100 feet deep.

The Board of Engineers, in their report on this phase of the inquiry, says: 'The abstraction of 10,000 cubic feet of water per second from Lake Michigan will lower the levels of all the lakes of the system, except Lake Superior, and reduce the navigable capacities of all harbours and shallows throughout the system to an *extent that may be determined if at all by actual measurement only.*' (The italics are mine.)

Again they say, 'The water levels of the Great Lakes are very delicate.'

Mark the phraseology used by the Board. The effect on the levels of the Great Lakes of the abstraction of 10,000 cubic feet per second from Lake Michigan, may be determined, if such determination be at all possible, ' by actual measurement only.' Manifestly the Board entertains grave doubts of its possibility under any circumstances. But if at all possible, it is only by pursuing the *modus* they recommend.

DESCRIPTIVE.

The brief, yet precise, description of the contemplated works given by the Board of Engineers admirably answers the needs and purposes of this report.

'The Main Drainage Channel of the Sanitary District of Chicago is now under contract from its confluence with the south branch of the Chicago river, at Roby Street, in the City of Chicago, to its southern terminus, in Will County, Ill. At the southern end of the channel the controlling works will be located. Beyond these works, the construction contemplated by the district will be the work necessary for conducting the flow of the Desplaines river, down the declivity to and through the City of Joliet, and making such change in the Illinois and Michigan Canal as the new conditions developed will make necessary.

'The first work put under contract extended south westerly from the Willow Springs road, and these sections were numbered consecutively Nos. 1 to 14. Average length of sections one mile. Easterly from Willow Springs road the sections are lettered from A to O, omitting J. The lettered sections are, except for a short distance near Summit, entirely in glacial drift, defined in the specifications thus: "Glacial drift shall comprise the top soil, earth, muck sand, gravel, clay, hard pan, boulders, fragmentary rock displaced from its original bed, and any other material that overlies the bedrock."

'The sections from 1 to 14 were put under contract in July, 1892; from A to F were put under contract late in 1892 and early in 1893; and G to M, inclusive, were contracted for in December, 1893. Sections N and O were put under contract May 2, and section 15, August 27, 1894. Earth was first broken on "Shovel Day," September 3, 1892, on the rock cut below Lemont.

'The Desplaines valley is traversed by the river from which it takes its name, a stream of wide fluctuations, with no constant and reliable fountain supply. During some seasons its whole discharge would pass through a 6-inch pipe, and at others its volume reaches 800,000 cubic feet per minute. Then it rolls majestically along, flooding the whole valley. Such being the situation, control of this stream was a condition precedent to the successful prosecution of the work upon the main channel. This control has been secured by the outlay of nearly $1,000,000 in constructing what is known as the River Diversion channel.

'About 13 miles of new river channel had to be excavated with the location of the Main Drainage channel, and about 19 miles of levee built to divorce the waters of the Desplaines watershed from the channel which is to receive the waters of Lake Michigan and pass them on to the Mississippi river via the lower Desplaines and the Illinois rivers. The width of the River Diversion channel on the bottom is 200 feet, side slopes, 1½ to 1, grade generally 0·12 ft. per 1,000 ft.

'At the head of this river diversion it was necessary to provide a safety valve in the form of a spillway to allow surplus water to flow toward Chicago, because arrangements have not as yet been perfected for carrying the entire flood waters of the Desplaines through Joliet.

'This spillway is a concrete dam capped with cut stone, and its wings faced with stone masonry; it is 397 ft. long, and its crest is 16·25 ft. above Chicago datum. (This datum is referred to the low water of Lake Michigan of 1847, and is 579·61 ft. above sea level at Sandy Hook). No water flows over this spillway until the volume passing the water gauge above it reaches 300,000 cubic feet per minute.

'The cross-section of the earth sections from A to E, inclusive, is 202 ft. on the bottom, with side slopes of 2 to 1. This section extends for about 500 ft. into the west end of F, and then reduces to 110 ft. on the bottom, preserving the same side slopes. The explanation for this change of cross-section is as follows: Throughout the rock sections, and those sections in which there is a preponderance of hard material, or where rock may appear, the section adopted is designed according to law for a flow of 600,000 cubic feet of water per minute, which means provision for a population of 3,000,000 people. The narrow channel provides for a flow 300,000 cubic feet per minute, or for about the present population of Chicago. The enlargement of the narrow channel can be made by the easier methods of excavation, such as dredging, whenever the needs of the city require it. The grade throughout the lettered sections is 1 ft. in 40,000 (·025 ft. per 1,000 ft.), and the bottom of the channel at Robey Street is 24,448 ft. below datum. The numbered sections, from No. 1 to No. 6 inclusive, are underlaid with solid rock. The width of the bottom, in rock, is 160 ft., and walls of masonry laid in cement will be built upon the rock surface to a height of 5 feet above datum. Sections 7 to 14, inclusive, are in solid rock; width at bottom, 160 ft.: sides vertical, prism taken out in three steps with offsets of 6 inches on each side for each cut, making top width of 162 ft., grade in rock, 1 ft. in 20,000 (·05 ft per 1,000).

'Section No. 15 is also in rock, and its cross-section is enlarged at its south end, so as to form a "windage basin" in which large vessels may be turned around. The controlling works are located on this section. These works will consist of gates or movable dams, by which the flow of water from the main channel into the tail-race, which is to deliver the outflow into the Desplaines river, can be controlled.

'This river below Lockport follows the trough of the valley down a steep declivity to the canal basin in Joliet. The fluctuations in Lake Michigan, by varying slope of water surface, will be felt at the controlling works, and provision must be made to meet these fluctuations within a range of 5 ft. above datum and 8 ft. below, or an extreme oscillation of 13 ft. The fall from datum at the controlling works to the level of the upper basin will be about 42 ft. in a distance of about 4¼ miles. As the plans for controlling works have not been finally adopted by the Board of Trustees, they cannot now be discussed.

'The total amount of excavation involved in the construction of the main channel is 26,077,765 cubic yds. of glacial drift, and 12,071,668 cubic yds. of solid rock, or an aggregate of 38,149,433 cubic yds., to which must be added the material excavated from the river diversion: Glacial drift, 1,564,403 cubic

yds.; solid rock, 258,926 cubic yds.; total river diversion, 1,823,329 cubic yds.; grand total, main channel and river diversion, 39,972,762 cubic yds. All of this work is now under contract, and in addition thereto 384,958 cubic yds. of retaining wall.'

The subjoined supplemental description is extracted from the paper of Lyman E. Cooley, Esq., C.E., M. Am. Soc. C. E., and a member of the Board of Trustees of the Sanitary District of Chicago:—

EFFECT OF THE CHICAGO DRAINAGE CANAL ON LAKE LEVELS.

' The work as now laid out provides for a main channel, which begins at a junction with the Chicago river, or rather the south branch thereof, in the southwest quarter of the city, at a point 5·8 miles from Lake Michigan, by the course of the river, and extends to the vicinity of Lockport, a distance of 28·05 miles from the point of beginning, where the water is to be discharged into the Desplaines river, and such work done along the bed thereof, for a distance of 7·1 miles, as is necessary to conduct the overflow safely through the city of Joliet.

' For 7·8 miles from Chicago the channel is being constructed with a present capacity of 5,000 cubic ft. per second, the future enlargement being simply a matter of dredging through comparatively easy material. The 20·25 miles in the Desplaines valley is through glacial drift of the most difficult character and through rock, and this part of the work is being carried out on the ultimate basis of capacity. The standard dimensions as adopted are, for 14·9 miles through the rock cut 160 ft. wide at bottom and 162 ft. at the top, with a declivity of one foot in 20,000 ft.: and in the earth and drift for a distance of 13·15 miles, 202 ft. wide at bottom and 290 ft. at the water line when the channel is carrying 22 ft. of water, with a declivity of 1 ft. in 40,000 ft., excepting, however, the 7·8 miles at the Chicago end, previously mentioned, which are being constructed with a width 92 ft. narrower than the standard earth section.

'The bottom of the channel, at its junction with the Chicago river, is actually 24·45 below datum, and at the Lockport end 30 ft., the total theoretical declivity being 5·65 ft. The capacity is figured on a depth of 22 ft. on a conservative basis, so as to make sure of meeting any requirement of the inspectors, who are to be independent agents of the state. It will be noticed that an allowance of 2·45 ft. is made in the grade at the Chicago end in order surely to meet any solution that may be demanded through a connection with Lake Michigan, in order to feed this channel to its full capacity. These additional works have not been provided for, nor have plans for the same been matured. Should these works be carried out on a liberal basis, the depth in the main channel will be increased 2 ft. at low water.

' It is proposed to open these works on the minimum capacity provided by law (assumed at not less than 5,000 cubic ft. per second, but actually 20,000 cubic ft. per minute for each 100,000 of population), and it is presumed that considerable work will be required in the Chicago river to pass the minimum volume without injury to navigation. Extensive works of a radical nature will be necessary to provide the ultimate volume, viz., 10,000 cubic ft. per second, and several years will be required for their development.

' The volume flowing in this channel will be regulated by controlling works at the lower end of Lockport, and by these means the discharge may be fixed and controlled at any amount or entirely stopped at pleasure.

'Aside from its sanitary utility, the channel is to be regarded as the most costly part of the waterway from Lake Michigan to the Mississippi, and as a useful extension of the harbour of Chicago for vessels of deep draught, and these objects were contemplated as important incidents of the work, and were fully expressed as the policy of the state when the law was passed.'

HYDRAULIC FORMULÆ.—DISCHARGE COMPUTATIONS.

As the mode of connection of the Chicago Drainage Channel with Lake Michigan is yet undetermined, all that is known with certainty of the contemplated draught on the lake is that there will be a minimum depth of 22 ft. of water in the channel at the junction of the drainage channel with the south branch of the Chicago river, at Robey Street, which is 5·8 miles by river from the lake. The elevation of the bed or bottom of the channel at this point is 24·45 feet below Chicago datum. Hence the elevation of the water surface in the channel will be 2·448 feet below Chicago datum. This is equivalent to —4·7+2·448=—7·148 feet below the plane of reference of the water level curves of Lake Michigan, as adopted by the United States Lake Survey.

The monthly mean level of Lake Michigan at Milwaukee, Wis., for the month of November, 1895, was —5·642 feet below the said plane of reference. This has been the lowest stage of the water in Lake Michigan, of which there is any record, up to date. Whether it has fallen still lower since, I am not aware. This would be equivalent to an elevation of the water surface of Lake Michigan of 1·5 feet above the water surface of the drainage channel at Robey Street junction with its minimum depth of 22 ft.

Assuming that for every oscillation of Lake Michigan there will be an equal and corresponding fluctuation of the drainage channel at Robey Street junction. Then, 2ndly, when the water of Lake Michigan will be one foot above the elevation of November, 1895, which nearly coincides with the low water of March, 1869, there will be a depth of 23 feet in the drainage channel at the Robey Street junction.

3rdly. When the water of Lake Michigan attains an elevation of two feet above that of November, 1895, there will be a depth of 24 feet in the drainage channel at Robey Street junction. This elevation nearly coincides with the low water of January, 1870, and February, 1888.

4thly. When the water of Lake Michigan attains an elevation of three feet above that of November, 1895, there will be a depth of 25 feet in the drainage channel at Robey street junction. This elevation nearly coincides with the low water of March, 1863, of January, 1884, of January, 1885, and of January, 1887; and with the high water of August, 1865, of June, 1860, of August, 1873, of September, 1875, and of August, 1880.

5thly. When the water of Lake Michigan attains an elevation of four feet above that of November, 1895, there will be a depth of 26 feet in the drainage channel at Robey Street junction. This elevation nearly coincides with the high water of July, 1860, and July, 1862.

6thly. When the water of Lake Michigan attains an elevation of five feet above that of November, 1895, there will be a depth of 27 feet in the drainage channel at Robey Street junction. The highest water of Lake Michigan since 1859, was in July of that year. It was only —0·25 feet below the stage of five feet above the low water of November, 1895. This stage is equivalent to 0·642 feet below the plane of reference, or supposed high water of 1838.

HYDRAULIC FORMULÆ.

DISCHARGE COMPUTATIONS.

1st.—ELEVATION OF LAKE SURFACE COINCIDENT WITH LOW WATER OF NOVEMBER, 1895.

1st.—CHANNEL IN EARTH.

CROSS-SECTION.

Width at bottom ..... 202 feet.
Depth of water ..... 22 "
Side slopes ..... 2 horizontal to 1 vertical.
Width at surface of water ..... (101+44)2=290 feet.

Sectional area A ..... $\frac{202+290}{2} \times 22 = 5{\cdot}412$ square feet.

Wetted perimeter ..... $101 + \sqrt{22^2+44^2} \times 2 = (101+49) \times 2 = 300$ feet.

Hydraulic mean radius ..... $\frac{5412}{300} = 18$ feet.

Slope of channel ..... 1 in 40,000, or ·000025 feet per foot linear.

1.—Kutter's Formula.

Assumed roughness of channel, $n = {\cdot}0275$, a mean between ·025 and ·03.

Mean velocity—

$$v = \left\{ \frac{41{\cdot}6 + \frac{1{\cdot}811}{n} + \frac{{\cdot}00281}{i}}{1 + \left(41{\cdot}6 + \frac{{\cdot}00281}{i}\right)\frac{n}{\sqrt{m}}} \right\} \sqrt{mi}$$

$$= \left\{ \frac{41{\cdot}6 + \frac{1{\cdot}811}{{\cdot}0275} + \frac{{\cdot}00281}{{\cdot}000025}}{1 + \left(41{\cdot}6 + \frac{{\cdot}00281}{{\cdot}000025}\right)\frac{{\cdot}0275}{\sqrt{18}}} \right\} \sqrt{18 \times {\cdot}000025}$$

$$= \left\{ \frac{41{\cdot}6}{1} \quad \frac{65{\cdot}85}{(41{\cdot}6 \times 112{\cdot}4) \times {\cdot}00648} \quad \frac{112{\cdot}4}{} \right\} \times {\cdot}0212$$

$$\frac{219{\cdot}85}{2} \times {\cdot}0212 = 2{\cdot}33 \text{ feet per second.}$$

Mean velocity—

2.—de Prony's Formula.

$$v = ({\cdot}0237 + 9966\, m\, i)^{\frac{1}{2}} - {\cdot}1542$$
$$= ({\cdot}0237 + 9966 \times 18 \times {\cdot}000025)^{\frac{1}{2}} - {\cdot}1542$$
$$= ({\cdot}0237 + 4{\cdot}485)^{\frac{1}{2}} - {\cdot}1542$$
$$= 2{\cdot}1233 - {\cdot}1542 = 1{\cdot}969 \text{ feet per second.}$$

3.—Dupuit's Formula

Mean velocity—

$${\cdot}0000323\, v^2 = i\,(1 + {\cdot}225) = (1 + {\cdot}225 \times 18) \times {\cdot}000025 = {\cdot}00012625$$

$$v^2 = \frac{{\cdot}00012625}{{\cdot}0000323} = 3{\cdot}9; \text{ and } v = \sqrt{3{\cdot}9} = 1{\cdot}975 \text{ feet per second.}$$

4.—Chezy's Formula.

Mean velocity—

$v = c\sqrt{mi}$, making $c = 100$. Substitute.

$$v = 100\ \sqrt{18 \times {\cdot}000025}$$
$$= 100\ \sqrt{{\cdot}00045}$$
$$= 100 \times {\cdot}0212$$
$$= 2{\cdot}12 \text{ feet per second.}$$

5.—Humphrey's and Abbot's Formula.

Mean velocity—

$$v = \left\{ \left(225 \frac{m}{2} \sqrt{i} \right)^{\frac{1}{2}} - \cdot 0388 \right\}^2$$

$$= \left\{ \left(225 \times \frac{18}{2} \sqrt{\cdot 000025} \right)^{\frac{1}{2}} - \cdot 0388 \right\}^2$$

$$= \left\{ \left(225 \times 9 \times \cdot 005 \right)^{\frac{1}{2}} - \cdot 0388 \right\}^2$$

$$= (1 \cdot 78 - \cdot 0388)^2$$

$$= \overline{1 \cdot 74}^2 = 3 \text{ feet per second.}$$

6.—Hagen's Formula.

Mean velocity—

$$v = 4 \cdot 39 \sqrt{m} \sqrt[6]{i}$$

$$= 4 \cdot 39 \sqrt{18} \sqrt[6]{\cdot 000025}$$

$$= 4 \cdot 39 \times 4 \cdot 22 \times \cdot 171.$$

$$= 3 \cdot 168 \text{ feet per second.}$$

7.—de Prony's with Weisbach's Coefficients.

Mean velocity—

$$v = \left(\cdot 00024 + 8675 \; m \, i \right)^{\frac{1}{2}} - \cdot 015$$

$$= \left(\cdot 00024 + 8675 \times 18 \times \cdot 000025 \right)^{\frac{1}{2}} - \cdot 015$$

$$= \left(\cdot 00024 + 3 \cdot 90375 \right)^{\frac{1}{2}} - \cdot 015$$

$$= \sqrt{3 \cdot 904} - \cdot 015$$

$$= 1 \cdot 97 - \cdot 015 = 1 \cdot 955 \text{ feet per second.}$$

8.—Rankine's Formula.

Mean velocity—

$$v = 8 \cdot 025 \sqrt{\frac{i \, m}{\cdot 007565}} = \sqrt{8512 \, i \, m} = 92 \cdot 26 \sqrt{i \, m}$$

$$= 92 \cdot 26 \sqrt{\cdot 000025 \times 18}$$

$$= 92 \cdot 26 \times \sqrt{\cdot 00045}$$

$$= 92 \cdot 26 \times \cdot 0212 = 1,956 \text{ feet per second.}$$

Mean velocities—

1.	By Kutter's formula	$v = 2 \cdot 32$	feet per second.
2.	" de Prony's "	$v = 1 \cdot 969$	"
3.	" Dupuit's "	$v = 1 \cdot 975$	"
4.	" Chezy's "	$v = 2 \cdot 12$	"
5.	" Humphreys' and Abbot's formula	$v = 3 \cdot 00$	"
6.	" Hagen's formula	$v = 3 \cdot 168$	"
7.	" de Prony's with Weisbach's coefficients	$v = 1 \cdot 955$	"
8.	" Rankine's formula	$v = 1 \cdot 956$	"
		$8)18 \cdot 435$	"
	Grand mean velocity	$v = 2 \cdot 304$	"

To find the probable errors by the method of least squares, assuming each of the formulas to have equal weights.

No. of Formula.	Velocity.	Difference from Mean.	Square of Residual Errors
1	2·32	−0·016	0·003
2	1·969	+0·335	0·1122
3	1·975	+0·329	0·1082
4	2·12	+0·184	0·0239
5	3·00	−0·696	0·4844
6	3·168	−0·864	0·7465
7	1·955	+0·309	0·0955
8	1·956	+0·308	0·0949
Mean =	2·304		$[n\,n_1,]$=1·6659

Probable error:

$$r = \cdot 6745\sqrt{\frac{[n\,n_1]}{m-1}} = \cdot 6745\sqrt{\frac{1\cdot 6659}{8-1}}$$

$$= \cdot 6745\ \sqrt{0\cdot 2380} = \cdot 6745 \times \pm 0\cdot 47$$

$$= \pm 0\cdot 317 \text{ feet.}$$

Probable error of arithmetical mean:

$$r\,(x) = \frac{\cdot 6745}{\sqrt{m}}\sqrt{\frac{[n\,n_1]}{m-1}} = \frac{\cdot 6745}{\sqrt{8}}\sqrt{\frac{1\cdot 6659}{8-1}}$$

$$= \frac{\cdot 6745}{2\cdot 8284}\ \sqrt{0\cdot 2380} = \cdot 2385 \times \pm 0\cdot 47$$

$$= 0\cdot 112 \text{ feet.}$$

Discharge, $D = 5412 \times 2\cdot 3 = 12{,}448$ cubic feet per second.

2ND. CHANNEL IN ROCK.

CROSS-SECTION.

Bottom width..... 160 feet.
Width at water surface..... 162 "
Mean width..... 161 "
Depth..... 22 "
Sectional area, $A = 161 \times 22 =$..... 3,542 square feet.
Wetted perimeter..... 204 feet.

Hydraulic means radius, $m =$ ..... $\left(\frac{3542}{204} = 17\cdot 36 \text{ feet.}\right.$

Slope, $i =$ ..... $\left.\left(\frac{1}{20{,}000} = \cdot 00005 \text{ feet per linear foot.}\right)\right.$

1.—Kutter's Formula.

Taking coefficient of roughness ·017, same as for rubble masonry.

Mean velocity—

$$v = \left\{\frac{41\cdot 6 + \frac{1\cdot 811}{n} + \frac{\cdot 00281}{i}}{1 + (41\cdot 6 + \frac{\cdot 00281}{i})\frac{n}{\sqrt{m}}}\right\}\sqrt{m\,i}$$

$$= \left\{\frac{41\cdot 6 + \frac{1\cdot 811}{\cdot 017} + \frac{\cdot 00281}{\cdot 00005}}{1 + (41\cdot 6 + \frac{\cdot 00281}{\cdot 00005})\frac{\cdot 017}{\sqrt{17\cdot 36}}}\right\}\sqrt{17\cdot 36 \times \cdot 00005}$$

$$= \left\{\frac{41\cdot 6 + 106\cdot 5 + 56\cdot 2}{1 + (41\cdot 6 + 56) \times \cdot 004}\right\} \times \cdot 0298$$

$$= \frac{204\cdot 3 \times \cdot 0298}{1 + \cdot 3804}$$

$$= \frac{6\cdot 088}{1\cdot 38} = 4\cdot 4 \text{ feet per second.}$$

2.—de Prony's Formula.

Mean velocity—

$$v = \left(\cdot 0237 + 9966\, m\, i\right)^{\frac{1}{2}} - \cdot 1542$$

$$= \left(\cdot 0237 + 9966 \times 17{\cdot}36 \times \cdot 00005\right)^{\frac{1}{2}} - \cdot 1542$$

$$= \sqrt{8{\cdot}68} - \cdot 1542$$

$$= 2{\cdot}95 - \cdot 1542$$

$$= 2{\cdot}79 \text{ feet per second.}$$

3.—Dupuit's Formula.

Mean velocity—

$$\cdot 0000323\, v^2 = i(1 + \cdot 225m).$$

$$= (1 + \cdot 225 \times 17{\cdot}36) \times \cdot 00005$$

$$= (1 + 3{\cdot}906) \times \cdot 00005 = 4{\cdot}906 \times 00005$$

$$= \cdot 000249$$

$$\therefore \quad v^2 = \frac{\cdot 000249}{\cdot 0000323} = 7{\cdot}713; \text{ and } v = 2{\cdot}78 \text{ feet per second.}$$

4.—Chezy's Formula.

Mean velocity—

$$v = c\ \sqrt{m\, i}. \quad \text{Calling } c = 100. \quad \text{Then}$$

$$v = 100\ \sqrt{17{\cdot}36 \times \cdot 00005}$$

$$= 100 \times \cdot 0295 = 2{\cdot}95 \text{ feet per second.}$$

5.—Humphrys and Abbot's Formula.

Mean velocity—

$$v = \left\{\left(225\, \frac{m}{2}\ \sqrt{i}\right)^{\frac{1}{2}} - \cdot 0388\right\}^2$$

$$= \left\{\left(225 \times \frac{17{\cdot}36}{2}\ \sqrt{\cdot 00005}\right)^{\frac{1}{2}} - \cdot 0388\right\}^2$$

$$= \left\{19{\cdot}53 \times \cdot 007\right)^{\frac{1}{2}} - \cdot 0388\right\}^2$$

$$- \left(1{\cdot}9229 - \cdot 0388\right)^2$$

$$= 3{\cdot}55 \text{ feet per second.}$$

6.—Hagen's Formula.

Mean velocity—

$$v = 4{\cdot}39\ \sqrt{m \cdot\ \sqrt[6]{i}}$$

$$= 4{\cdot}39\ \sqrt{17{\cdot}36 \cdot\ \sqrt[6]{\cdot 00005}}$$

$$4{\cdot}39 \times 4{\cdot}17 \times \cdot 191 = 3{\cdot}499 \text{ feet per second.}$$

7.—De Prony's Formula with Wiesbach's coefficients.

Mean velocity—

$$v = \left(\cdot 00024 + 8675\, m\, i\right)^{\frac{1}{2}} - \cdot 015$$

$$= \left(\cdot 00024 + 8675 \times 17{\cdot}36 \times \cdot 00005\right)^{\frac{1}{2}} - \cdot 015$$

$$= \left(\cdot 00024 + 7{\cdot}53\right)^{\frac{1}{2}} - \cdot 015$$

$$= \sqrt{7{\cdot}53024} - \cdot 015$$

$$= 2{\cdot}745 - \cdot 015$$

$$= 2{\cdot}73 \text{ feet per second.}$$

8.—Rankine's Formula.

For first approximation, $f = \cdot 007565$

Mean velocity—

$$v' = 8{\cdot}025 \sqrt{\frac{i\, m}{\cdot 007565}} = \sqrt{8512\, i\, m} + 92{\cdot}26\ \sqrt{i\, m}$$

$$= 92{\cdot}26\ \sqrt{\cdot 00005 \times 17{\cdot}36}$$

$$= 92{\cdot}26\ \sqrt{\cdot 000868}$$

$$= 92{\cdot}26 \times \cdot 0295 = 2{\cdot}72 \text{ feet.}$$

For a second approximation.

$$f = \left(\cdot0074 + \frac{\cdot00023}{2\cdot72}\right) = \cdot0074 + \cdot0000848 = \cdot0074848$$

$$\frac{3}{4} - \frac{f}{\cdot01513} = \frac{3}{4} - \frac{\cdot0074848}{\cdot01513} = 1\cdot5 - \cdot4947 = 1\cdot0053$$

$$v = 2\cdot72 \times 1\cdot0053 = 2\cdot735 \text{ feet per second.}$$

Mean velocities—

(1)	By Kutter's formula	$v =$	4·4 feet per second.
(2)	" De Prony's formula	$v =$	2·79 "
(3)	" Dupuit's formula	$v =$	2·78 "
(4)	" Chezy's formula	$v =$	2·95 "
(5)	" Humphreys and Abbot's formula	$v =$	3·55 "
(6)	" Hagen's formula	$v =$	3·499 "
(7)	" De Prony's with Weisbach's formula	$v =$	2·73 "
(8)	" Rankine's formula	$v =$	2·735 "
			8)25·434
			"
	Grand mean velocity	$v =$	3·18 "

To find the probable errors by the method of least squares, assuming each of the formulas to have equal weights.

No. of Formula.	Velocity.	Difference from mean.	Square of Residual errors.
1	4·4	−1·22	1·4844
2	2·79	+0·39	0·1521
3	2·78	+0·40	0·1600
4	2·95	+0·23	0·0529
5	3·55	−0·37	0·1369
6	3·499	−0·32	0·1024
7	2·73	+0·48	0·2304
8	2·735	+0·445	0·1891
Mean =	3·18	$[n\,n_1]$ =	2·5172

Probable error :—

$$r = \cdot6745\sqrt{\frac{[n\,n_1]}{m-1}} = \cdot6745\sqrt{\frac{2\cdot5172}{8-1}}$$

$$= \cdot6745\ \sqrt{0\cdot3596} = \cdot6745 \times \pm 0\cdot6$$

$$= \pm 0\cdot415 \text{ feet.}$$

Probable error of arithmetical mean—

$$r\,(x) = \frac{\cdot6745}{\sqrt{m}}\sqrt{\frac{[n\,n_1]}{m-1}} = \frac{\cdot6745}{\sqrt{8}}\sqrt{\frac{5\cdot2172}{8-1}}$$

$$= \frac{\cdot6745}{2\cdot8284}\ \sqrt{0\cdot3596} = \cdot2385 \times \pm 0\cdot6$$

$$= \pm 0\cdot143 \text{ feet.}$$

Mean discharge, D = 3542 × 3·18 = 11,264 cubic feet per second.
" in earth section = 12,448 cubic feet per second.
" rock " = 11,335 "

Difference = 1,113

To discharge this additional quantity through the contracted channel, there must be an increased head of pressure at the contracted outlet. This is provided for not only through the declivity of 1·74 feet in the clay cut, but also by an increased depth of 2·45 feet at Robey St. junction.

2NDLY.—*Elevation of lake surface one foot above low water of November, 1895*

1st.—Channel in Earth.

CROSS-SECTION.

Width at Bottom.... .. .... 202 feet.
Depth..... .. .. 23 "
Side slopes.....2 horizontal to 1 vertical.
Width at water surface, (101 + 46)2 =..... ..... 294 feet.

Sectional area, $A = \frac{202 + 294}{2} \times 23 =$ .. ..5,704 square feet

Wetted perimeter, $(101 + \sqrt{23^2 + 46^2})\ 2 = (101 + 51{\cdot}5) \times 2 =$.....305 feet

Hydraulic mean radius, m $\frac{5704}{305} =$ .. . .18·7 feet

Slope of channel, $i = \frac{1}{40000} =$ .....·000025 feet per foot linear.

1.—Kutter's Formula.

Mean velocity—

$$v = \frac{\left(41{\cdot}6 + \frac{1{\cdot}811}{n} + \frac{{\cdot}00281}{i}\right)}{\left(1 + \left(41{\cdot}6 + \frac{{\cdot}00281}{i}\right)\frac{n}{\sqrt{m}}\right)} \sqrt{mi}$$

$$= \frac{\left(41{\cdot}6 + \frac{1{\cdot}811}{{\cdot}0275} + \frac{{\cdot}00281}{{\cdot}000025}\right)}{\left(1 + \left(41{\cdot}6 + \frac{{\cdot}00281}{{\cdot}000025}\right)\frac{{\cdot}0275}{\sqrt{18{\cdot}7}}\right)} \sqrt{18{\cdot}7 \times {\cdot}000025}$$

$$= \left(\frac{41{\cdot}6 + 65{\cdot}85 + 112{\cdot}4}{1 + (41{\cdot}6 + 112{\cdot}4) \times {\cdot}000636}\right) \times {\cdot}0216$$

$$= \frac{219{\cdot}85}{1{\cdot}98} \times {\cdot}0216$$

$$= 111 \times {'}0216$$

$$= 2{\cdot}4 \text{ feet per second.}$$

2.—de Prony's Formula.

Mean velocity—

$$v = \left({\cdot}0237 + 9966mi\right)^{\frac{1}{2}} - {\cdot}1542$$

$$= \left({\cdot}0237 + 9966 \times 18{\cdot}7 \times {\cdot}000025\right)^{\frac{1}{2}} - {\cdot}1542$$

$$= \left({\cdot}0237 + 4{\cdot}6591\right)^{\frac{1}{2}} - {\cdot}1542$$

$$= \sqrt{4{\cdot}6828} - {\cdot}1542$$

$$= 2{\cdot}164 - 1542. \qquad = 2 \text{ feet per second.}$$

3.—Dupuit's Formila.

Mean velocity—

$$\cdot 0000323v^2 = i(1 + 225m)$$
$$= (1 + {\cdot}225 \times 18{\cdot}7) \times {\cdot}000025$$
$$= (1 + 4{\cdot}2125) \times {\cdot}000025$$
$$= 5{\cdot}2125 \times {\cdot}000025 = {\cdot}00013$$

Then

$$v^2 = \frac{{\cdot}00013}{{\cdot}0000323} = 4; \text{ and}$$

$v = 2$ feet per second.

4.—Chezy's Formula.

Mean velocity—

$v = c\ \sqrt{mi}$. Making $c = 100$.

Then

$$v = 100\ \sqrt{18.7 + .000025}$$
$$= 100 \times {\cdot}0216$$
$$= 2{\cdot}16 \text{ feet per second.}$$

5.—Humphreys and Abbot's Formula.

Mean velocity—

$$v = \left\{\left(225\ \frac{m}{2}\ \sqrt{i}\right)^{\frac{1}{2}} - \cdot0388\right\}^2$$

$$= \left\{\left(225 \times \frac{18\cdot7}{2}\ \sqrt{\cdot000025}\right)^{\frac{1}{2}} - \cdot0388\right\}^2$$

$$= \left(\sqrt[4]{\frac{21\cdot038}{2}} = \cdot0388\right)^2$$

$$= \left(\sqrt[4]{10\cdot519} - \cdot8388\right)^2$$

No. Log.

$10\cdot519 = 1\cdot0219745 \div 4 = 0\cdot2554937$

$1\cdot7927 = 0\cdot2554937$

$v = (1\cdot7927 - \cdot0388)^2 = 1\cdot754)^2$

$3\cdot07$ feet per second.

6.—Hagen's Formula.

Mean velocity—

$$v = \sqrt[6]{m}\ \sqrt{i} = 4\cdot39 \times \sqrt[6]{18\cdot7}\ \sqrt{\cdot000025}$$

$$= 4\cdot39 \times 4\cdot32 \times \cdot171$$

$$= 3\cdot24 \text{ feet per second.}$$

7.—de Prony's with Weisbach's Coefficients.

Mean velocity—

$$v = \left(\cdot00024 + 8695\ m\ i\right)^{\frac{1}{2}} - \cdot015$$

$$= \left(\cdot00024 + 8695 \times 18\cdot7 \times \cdot000025\right)^{\frac{1}{2}} - \cdot015$$

$$= \left(\cdot00024 + 4\cdot056\right)^{\frac{1}{2}} - \cdot015$$

$$= \sqrt{4\cdot0557} - \cdot015$$

$$= 2\cdot014 - \cdot015 = 2 \text{ feet per second.}$$

8.—Rankine's Formula.

Mean velocity—1st. Approximation—

$$v' = 8\cdot025\ \sqrt{\frac{m\ i}{\cdot007565}} = \sqrt{8512\ m\ i} = 92\cdot26\ \sqrt{m}$$

$$= 92\cdot26\ \sqrt{18\cdot7 \times \cdot000025}$$

$$= 92\cdot26\ \sqrt{\cdot0004675}$$

$$= 92\cdot26 \times \cdot0216 = 1\cdot99 \text{ feet.}$$

$$f = \left(\cdot0074 + \frac{\cdot00023}{1\cdot99}\right)$$

$$= (\cdot0074 + \cdot000116) = \cdot007516$$

Corrected value—

$$v = 1\cdot99\left(\frac{3}{2} = \frac{f}{\cdot01513}\right) = 1\cdot99\left(1\cdot5 - \frac{\cdot007516}{\cdot01513}\right)$$

$$= 1\cdot99\ (1\cdot5 - \cdot497) = 1\cdot99 \times 1\cdot003$$

$$= 1\cdot99 \text{ feet per second.}$$

Mean velocities.

(1)	By Kutter's formula	$v = 2\cdot4$ feet per second.
(2)	" de Prony's "	$v = 2\cdot0$ "
(3)	" Dupuit's "	$v = 2\cdot0$ "
(4)	" Chezy's "	$v = 2\cdot16$ "
(5)	" Humphreys and Abbot's formula	$v = 3\cdot07$ "
(6)	" Hagen's formula	$v = 3\cdot24$ "
(7)	" de Prony's with Weisbach's co-efficients	$v = 2\cdot0$ "
(8)	" Rankine's formula	$v = 1\cdot99$ "
		8)18·86
	Grand mean velocity	$v = 2\cdot36$

To find the probable errors by the method of least squares, assuming each of the formulas to have equal weights.

No. of Formula.	Velocity.	Difference from mean.	Square of Residual Error.
1.	2·4	−0·04	0·0016
2.	2·0	+0·36	0·1296
3.	2·0	+0·36	0·1296
4.	2·16	+0·20	0·0400
5.	3·07	−0·71	0·5141
6.	3·24	−0·88	0·7744
7.	2·0	+0·36	0·1296
8.	1·99	+0·37	0·1369
	Mean = 2·36		$[nn_1] = 1·8555$

Probable error—

$$r = ·6745\sqrt{\frac{[nn_1]}{m-1}} = ·6745\sqrt{\frac{1·8556}{8-1}}$$

$$= ·6745\ \sqrt{0·2651} = ·6745 \times \pm 0·51$$

$$= \pm 0·345 \text{ feet.}$$

Probable error of arithmetical mean—

$$r\,(x) = \frac{·6745}{\sqrt{m}}\sqrt{\frac{[nn_1]}{m-1}} = \frac{·6745}{\sqrt{8}}\sqrt{\frac{1·8556}{8-1}}$$

$$= \frac{·6745}{2·8284}\sqrt{0·2651} = ·2385 \times \pm 0·51$$

$$= 0·122 \text{ feet.}$$

Mean discharge, D, = 5704 × 2·36 = 13,460 cubic feet per second.

2nd—Channel in Rock.

CROSS-SECTION.

Width at bottom	160 feet.
" surface	162 "
Mean width	161 "
Depth	23 "
Sectional area, A = 161 × 23	3,703 square feet.
Wetted perimeter = 160 + 23 × 2	206 feet.
Hydraulic mean radius, $m = \frac{3703}{206}$	18 do
Slope, i = 1 in 20,000	·00005 feet per foot linear.

1.—Kutter's Formula.

Coefficient of roughness, n = ·017, same as rubble.

Mean velocity—

$$v = \left\{\frac{41·6 + \frac{1·811}{n} + \frac{·00281}{i}}{1 + \left(41·6 + \frac{·00281}{i}\right)\frac{n}{\sqrt{m}}}\right\}\sqrt{m\,i}$$

$$= \left\{\frac{41·6 + \frac{1·811}{·017} + \frac{·00281}{·00005}}{1 + \left(41·6 + \frac{·00281}{·00005}\right)\frac{·017}{\sqrt{18}}}\right\}\sqrt{18 \times ·00005}$$

$$= \left\{\frac{41·6 + 106·5 + 56·2}{1 + \left(41·6 + 56\right)\frac{·017}{4·24}}\right\}\sqrt{·0009}$$

$$= \left(\frac{204·3}{1 + 97·6 \times ·004}\right)\sqrt{·0009}$$

$$= \frac{204·3 \times ·03}{1 + 38} = \frac{6·129}{1·38}$$

$$= 4·44 \text{ feet per second.}$$

2.—de Prony's Formula.

Mean velocity—

$$v = \left(\cdot 0237 + 9966\ m\ i\right)^{\frac{1}{2}} - \cdot 1542.$$

$$= \left(\cdot 0237 + 9966 \times 18 \times \cdot 00095\right)^{\frac{1}{2}} \cdot 1542.$$

$$= \left(\cdot 0237 + 8 \cdot 87\right)^{\frac{1}{2}} - \cdot 1542$$

$$= \sqrt{8 \cdot 8937} - \cdot 1542$$

$$= 2 \cdot 9822 - \cdot 1542$$

$$= 2 \cdot 828 \text{ feet per second.}$$

3.—Dupuit's Formula.

Mean velocity—

$$\cdot 0000323\ v^2 = i\ (1 + \cdot 225\ m) = (1 + \cdot 225 \times 18) \times \cdot 00005$$

$$= (1 + 4 \cdot 05) \times \cdot 00005$$

$$= 5 \cdot 05 \times \cdot 00005 = \cdot 0002525$$

$$\therefore \quad v^2 = \frac{\cdot 0002525}{\cdot 0000323} = 7 \cdot 82$$

$$v = \sqrt{7 \cdot 82} = 2 \cdot 8 \text{ feet per second.}$$

4.—Chezy's Formula.

Mean velocity—

$$v = c\ \sqrt{m\ i}.\quad c \text{ is taken at } 100 \cdot \text{ substitute.}$$

$$v = 100\ \sqrt{18 \times \cdot 00005}$$

$$= 100\ \sqrt{\cdot 009}$$

$$= 100 \times \cdot 03$$

$$= 3 \text{ feet per second.}$$

5.—Humphreys and Abbot's Formula.

Mean velocity—

$$v = \left\{\left(225\ \frac{m}{2}\ \sqrt{i}\right)^{\frac{1}{2}} - \cdot 0388\ \right\}^2$$

$$= \left\{\left(225 \times \frac{18}{2}\ \sqrt{\cdot 00005}\right)^{\frac{1}{2}} = \cdot 0382\right\}^2$$

$$= \left\{\left(225 \times 9 \times \cdot 007\right)^{\frac{1}{2}} - \cdot 0388\right\}^2$$

$$= \left(\sqrt[4]{14 \cdot 175} - \cdot 0388\right)^2$$

$$= \left(1 \cdot 34 - \cdot 0388\right)^2$$

$$= \left(1 \cdot 92\right)^2$$

$$= 3 \cdot 71 \text{ feet per second.}$$

6.—Hagen's Formula.

Mean velocity—

$$v = 4 \cdot 39\ \sqrt{m} \cdot \sqrt[6]{i}$$

$$= 4 \cdot 39\ \sqrt{18} \cdot \sqrt[6]{\cdot 00005}$$

$$= 4 \cdot 39 \times 4 \cdot 24 \times \cdot 191$$

$$= 3 \cdot 555 \text{ feet per second.}$$

7.—DeProny's Formula with Weisbaschs' Coefficients.

Mean velocity—

$$v = \left(\cdot 00024 + 8675\ m\ i\right)^{\frac{1}{2}} - \cdot 015$$

$$= \left(\cdot 00024 + 8675 \times 18 \times \cdot 00005\right)^{\frac{1}{2}} - \cdot 015$$

$$= \sqrt{7 \cdot 80774} - \cdot 015$$

$$= 2 \cdot 794 - \cdot 015$$

$$= 2 \cdot 78 \text{ feet per second.}$$

8.—Rankine's Formula.

Mean velocity—

$$v = 8{\cdot}025 \sqrt{\frac{i\,m}{{\cdot}007565}} = \sqrt{8512\ i\,m} = 92{\cdot}26\ \sqrt{i\,m}$$

$$= 92{\cdot}26\ \sqrt{18 \times {\cdot}00005}$$

$$= 92{\cdot}26\ \sqrt{{\cdot}009}$$

$$= 92{\cdot}26 \times {\cdot}03$$
$$= 2{\cdot}768 \text{ feet per second.}$$

Mean velocities.

(1) By Kutter's formula	$v = 4{\cdot}44$	feet per second.
(2) " De Prony's formula	$v = 2{\cdot}828$	"
(3) " Dupuit's "	$v = 2{\cdot}8$	"
(4) " Chezy's "	$v = 3{\cdot}0$	"
(5) " Humphreys and Abbot's formula	$v = 3{\cdot}71$	"
(6) " Hagen's formula	$v = 3{\cdot}555$	"
(7) " De Prony's with Weisbach's coefficients	$v = 2{\cdot}78$	"
(8) " Rankine's formula	$v = 2{\cdot}768$	"
	8)25·881	
Grand mean velocity	$v = 3{\cdot}24$	"

To find the probable errors by the method of least squares, assuming each formula to have equal weights.

Number of Formula.	Velocity.	Difference from Mean.	Square of Residuals.
1	4·44	−1·20	1·4400
2	2·828	+0·412	0·1697
3	2·8	+0·44	0·1936
4	3·0	+0·24	0·0576
5	3·71	+0·47	0·2209
6	3·555	−0·315	0·0993
7	2·78	+0·46	0·2116
8	2·768	+0·472	0·2228
Mean	3·24		$[nn_1]$ 2·6155

Probable error—

$$r = {\cdot}6745 \sqrt{\frac{[n\ n_1]}{m-1}} = {\cdot}6745 \sqrt{\frac{2{\cdot}6155}{8-1}}$$

$$= {\cdot}6745\ \sqrt{0{\cdot}4736} = {\cdot}6745 \times \pm 0{\cdot}61$$
$$= \pm 0{\cdot}41 \text{ feet.}$$

Probable error of arithmetical mean—

$$r = \frac{.6745}{\sqrt{m}} \sqrt{\frac{[n\,n_1]}{m-1}} = \frac{.6745}{\sqrt{8}} \sqrt{\frac{2{\cdot}6155}{8-1}}$$

$$= \frac{.6745}{2{\cdot}8284}\ \sqrt{0{\cdot}3736} = {\cdot}2385 \times \pm\ 0{\cdot}61$$
$$= \pm 0{\cdot}145 \text{ feet.}$$

Discharge, D = 3703 × 3·24 = 12,000 cubic feet per second.

3RDLY.—Elevation of lake surface two feet above low water of Novemiber, 1895.

1st.—CHANNEL IN EARTH.

CROSS-SECTION.

Width at bottom . . . . 202 feet.
Death. . . . . 24 "
Side slopes. . . . . 2 horizontal to 1 vertical.
Width at water surface. . . . . $(101 + 48) \times 2 = 298$ feet.
Sectional area A. . . . $\left(\frac{202 + 298}{2}\right) \times 24 = 6{,}000$ square feet
Slope. . . . . $i = 1$ in $40{,}000 = \cdot 000025$ feet per foot linear
Wetted perimeter. . . . . $(101 + \sqrt{24^2 + 48^2}) \times 2$
$= (101 + 53 \cdot 66) \times 2$
$= 154\ 66 \times 2 = 309 \cdot 33$ feet.
Hydraulic mean radius. . . . . $m = \frac{6000}{309 \cdot 3} = 19 \cdot 4$ "

1.—Kutter's Formula.

Mean velocity—

$$v = \left\{ \frac{41 \cdot 6 + \frac{1 \cdot 811}{n} + \frac{\cdot 00281}{i}}{1 + \left(41 \cdot 6 + \frac{\cdot 00281}{i}\right) \frac{n}{\sqrt{m}}} \right\} \sqrt{m\, i}$$

$$= \left\{ \frac{41 \cdot 6 + \frac{1 \cdot 811}{\cdot 0275} + \frac{\cdot 00201}{\cdot 000025}}{1 + \left(41 \cdot 6 + \frac{\cdot 00281}{\cdot 000025}\right) \frac{\cdot 0275}{\sqrt{19 \cdot 4}}} \right\} \sqrt{19 \cdot 4 \times \cdot 000025}$$

$$= \left\{ \frac{41 \cdot 6 + 65 \cdot 85 + 112 \cdot 4}{1 + (41 \cdot 6 + 112 \cdot 4 \frac{\cdot 0275}{4 \cdot 4}} \right\} \sqrt{\cdot 000485}$$

$$= \left(\frac{219 \cdot 85}{1 + 154 \times \cdot 00625} \right) \times \cdot 021 = \frac{219 \cdot 85}{1 + \cdot 9625} \times \cdot 021$$

$= 112 \times \cdot 021 = 2 \cdot 4$ feet per second.

2.—de Prony's Formula.

Mean velocity—

$$v = (\cdot 0237 + 9966\, mi)^{\frac{1}{2}} - \cdot 1542$$

$$= (\cdot 0237 + 9966 \times 19\ 4 \times \cdot 000025)^{\frac{1}{2}} - \cdot 1542$$

$$= (\cdot 0237 + 4 \cdot 8335)^{\frac{1}{2}} - \cdot 1542$$

$$= \sqrt{4 \cdot 8572} - \cdot 1542$$

$= 2 \cdot 2 - \cdot 1542 = 2 \cdot 04$ feet per second.

3.—Dupuit's Formula.

Mean velocity—

$$\cdot 0000323\ v^2 = i\ (1 + \cdot 225\ m)$$
$$= (1 + 4 \cdot 35) \times \cdot 000025$$
$$= (1 + \cdot 225 \times 19 \cdot 4) \times \cdot 000025$$
$$= 5 \cdot 35 \times \cdot 000025 = \cdot 000134$$

$$\therefore\ v^2 = \frac{\cdot 000134}{\cdot 0000323} = 4 \cdot 5$$

$v = 2 \cdot 04$ feet per second.

4.—Chezy's Formula.

Mean velocity—

$$v = c \sqrt{m\, i}$$

$$= 100 \sqrt{19 \cdot 4 \times \cdot 000025}$$

$$v = 100 \sqrt{\cdot 000485}$$

$= 100 \times \cdot 022 = 2 \cdot 2$ feet per second.

5.—Humphreys and Abbot's Formula.

Mean velocity—

$$v = \left\{ \left(225 \frac{m}{2} \sqrt{i} \right)^{\frac{1}{2}} - \cdot 0388 \cdot \right\}^2$$

$$= \left\{ \left(225 \times \frac{19 \cdot 4}{2} \sqrt{\cdot 000025} \right)^{\frac{1}{2}} - \cdot 0388 \right\}^2$$

$$= \left(\sqrt[4]{10 \cdot 6625} - \cdot 0388 \right)^2$$

$$= \left(1 \cdot 8 - \cdot 0488 \right)^2$$

$$= \overline{176}^2 = 3 \cdot 1 \text{ feet per second.}$$

6.—Hagen's Formula.

Mean velocity—

$$v = 4 \cdot 39 \sqrt{m} \cdot \sqrt[6]{i}$$

$$= 4 \cdot 39 \sqrt{19 \cdot 4} \cdot \sqrt[6]{\cdot 0000 - 25}$$

$$= 4 \cdot 39 \times 4 \cdot 4 \times \cdot 171$$

$$= 3 \cdot 3 \text{ feet per second.}$$

7.—De Prony's with Weisbach's Coefficients.

Mean velocity—

$$v = \left(\cdot 00024 + 8675 \, m \, i \right)^{\frac{1}{2}} - \cdot 015$$

$$= \left(\cdot 00024 + 8675 \times 19 \cdot 4 \times \cdot 000025 \right)^{\frac{1}{2}} - \cdot 015$$

$$= \left(\cdot 00024 + 4 \cdot 20738 \right)^{\frac{1}{2}} - \cdot 015$$

$$= \sqrt{4 \cdot 20762} - \cdot 015$$

$$= 2 \cdot 05 - \cdot 015$$

$$= 2 \cdot 035 \text{ feet per second.}$$

8.—Rankine's Formula.

Mean velocity—

$$v = 8 \cdot 025 \sqrt{\frac{m \, i}{\cdot 007565}} = \sqrt{8512 \, m \, i} = 92 \cdot 26 \sqrt{m \, i}$$

$$= 92 \cdot 26 \sqrt{19 \cdot 4 + \cdot 000025}$$

$$= 92 \cdot 26 \sqrt{\cdot 000485}$$

$$+ 92 \cdot 26 \sqrt{\cdot 022} = 2 \cdot 02 \text{ feet per second.}$$

Mean velocities.

1	By Kutter's formula	$v = 2 \cdot 4$ feet per second.
2.	" de Prony's "	$v = 2 \cdot 04$ "
3.	" Dupuit's "	$v = 2 \cdot 04$ "
4.	" Chezy's "	$v = 2 \cdot 2$ "
5	" Humphreys and Abbot's formula	$v = 3 \cdot 1$ "
6	" Hagan's formula	$v = 3 \cdot 3$ "
7.	" de Prony's with Weisbach's Co-efficients	$v = 2 \cdot 035$ "
8	" Rankine's formula	$v = 2 \cdot 02$ "
		$8)19 \cdot 135$
	Grand mean velocity	$v = 2 \cdot 4$

To find the probable errors by the method of least squares, assuming each of the formulas to have equal weight.

Number of Formula.	Velocity.	Difference from Mean.	Square of Residuals.
1.	2·4	−0·00	0·0000
2.	2·04	+0·36	0·1296
3.	2·04	+0·36	0·1296
4	2·2	+0·2	0·0400
5.	3·1	−0·7	0·4900
6.	3·3	−0·9	0·8100
7.	2·035	+0·365	0·1333
8	2·02	+0·38	0·1444
	Mean = 2·4		$[n\ n_1]$ = 1·8769

Probable error—

$$r = \cdot 6745 \sqrt{\frac{[n\ n_1]}{m-1}} = \cdot 6745 \sqrt{\frac{1 \cdot 8769}{8-1}}$$

$$= 6745\ \sqrt{0 \cdot 2681} = \cdot 6745 \times \pm 0 \cdot 518$$

$$= \pm\ 0.349 \text{ feet.}$$

Probable error of Arithmetical Mean—

$$r\,(x) = \frac{\cdot 6745}{\sqrt{m}} \sqrt{\frac{[n\ n_1]}{m-1}} = \frac{\cdot 6745}{\sqrt{8}} \sqrt{\frac{1 \cdot 8769}{8-1}}$$

$$= \frac{\cdot 6745}{2 \cdot 8284}\ \sqrt{0 \cdot 2681}$$

$$= \cdot 2385 \times \pm 0 \cdot 518 = \pm 0 \cdot 123 \text{ feet.}$$

Discharge, D = 6,000 × 2·4 = 14,400 cubic feet per second.

2ND. CHANNEL IN ROCK.

CROSS-SECTION.

Width at bottom	160 feet.
Width at water surface	162 "
Mean width	161 "
Depth	24 "
Sectional area	$A = 161 \times 24 = 3,864$ square feet.
Wetted perimeter	$160 \times 24 \times 2 = 208$ feet.
Hydraulic mean radius	$m = \frac{3864}{208} = 18 \cdot 58$ feet.
Slope	$i = 1$ in 20,000 = 00005 feet per foot linear.

1.—Kutter's Formula.

Co-efficient of roughness, = ·017; same as rubble masonry.

Mean velocity—

$$v = \left\{ \frac{41 \cdot 6 + \frac{1 \cdot 811}{n} + \frac{\cdot 00281}{i}}{1 \times \left(41 \cdot 6 + \frac{\cdot 00281}{i}\right) \frac{n}{\sqrt{m}}} \right\} \sqrt{m\,i}$$

$$= \left\{ \frac{41 \cdot 6 + \frac{1 \cdot 811}{\cdot 017} + \frac{\cdot 00281}{\cdot 00005}}{1 + \left(41 \cdot 6 + \left(\frac{\cdot 00281}{\cdot 00005}\right)\right) \frac{\cdot 017}{\sqrt{18 \cdot 58}}} \right\} \sqrt{18 \cdot 58 \times \cdot 00005}$$

$$= \left\{ \frac{41 \cdot 6 + 106 \cdot 5 + 56 \cdot 2}{1 + (41 \cdot 6 + 56 \cdot 2)\ \frac{\cdot 017}{4 \cdot 31}} \right\} \sqrt{\cdot 000929}$$

$$= \frac{204 \cdot 3}{1 + 97 \cdot 6 \times \cdot 004} \times \cdot 0305$$

$$= \frac{204 \cdot 3 \times \cdot 0305}{1 + \cdot 39}$$

$$= \frac{6 \cdot 231}{1 \cdot 39}$$

$$= 4.48 \text{ feet per second.}$$

2. de Prony's Formula.

Mean velocity—

$$v = (\cdot 0237 + 9966\ mi)^{\frac{1}{2}} - \cdot 1542$$
$$= (\cdot 0237 + 9966 \times 18 \cdot 58 \times \cdot 00005)^{\frac{1}{2}} - \cdot 1542$$
$$= (\cdot 0237 + 9 \cdot 2584)^{\frac{1}{2}} - \cdot 1542$$
$$= 3 \cdot 0466 - \cdot 1542$$
$$= 2 \cdot 89 \text{ feet per second.}$$

3.—Dupuit's Formula.

Mean velocity—

$$\cdot 0000323\ v^2 = i\ (1 + \cdot 225m)$$
$$= (1 + \cdot 225 \times 18 \cdot 58) \times \cdot 00005$$
$$= (1 + 4 \cdot 18) \times \cdot 00005 = \cdot 000259$$
$$\therefore \quad v^2 = \frac{\cdot 000259}{\cdot 0000323} = 8$$
$$v = 2 \cdot 83 \text{ feet per second.}$$

4.—Chezy's Formula.

Mean velocity—

$$v = c\ \sqrt{m\ i}, \quad c \text{ is taken} = 100, \text{ substitute.}$$
$$v = 100\ \sqrt{18 \cdot 58 \times \cdot 00005}$$
$$= 100 \times \cdot 0305$$
$$= 3 \cdot 05 \text{ feet per second.}$$

5. Humphreys and Abbot's Formula.

Mean velocity—

$$v = \left\{\left(225\ \frac{m}{2}\ \sqrt{i}\ \right)^{\frac{1}{4}} - \cdot 0388\right\}^2$$
$$= \left\{\left(225 \times \frac{18 \cdot 58}{2}\ \sqrt{\cdot 00005}\right)^{\frac{1}{4}} - \cdot 0388\right\}^2$$
$$= \left\{\left(225 \times 9 \cdot 29 \times \cdot 007\right)^{\frac{1}{4}} = \cdot 0338\right\}^2$$
$$= \left\{\sqrt[4]{14 \cdot 63175} - \cdot 0300\right\}^2$$
$$= (1 \cdot 9545 - \cdot 0388)^2$$
$$= \overline{1 \cdot 916}\Big)^2 = 3 \cdot 95 \text{ feet per second.}$$

6.—Hagen's Formula.

Mean velocity—

$$v = 4 \cdot 39\ \sqrt{m}\ \ \sqrt[6]{i}$$
$$= 4 \cdot 39\ \sqrt{18 \cdot 58}\ \ \sqrt[6]{\cdot 00005}$$
$$= 4 \cdot 39 \times 4 \cdot 31 \times \cdot 191$$
$$= 3 \cdot 614 \text{ feet per second.}$$

7.—de Prony's Formula with Weisbach's Coefficients.

Mean velocity—

$$v = \left(.00024 + 8675\ m\ i\right)^{\frac{1}{2}} - .015$$
$$= \left(.00024 + 8675 \times 19 \cdot 58 \times \cdot 00005\right)^{\frac{1}{2}} - \cdot 015$$
$$= \sqrt{8 \cdot 06} - \cdot 015$$
$$= 2 \cdot 84 - \cdot 015$$
$$= 2 \cdot 825 \text{ feet per second.}$$

8.—Rankine's Formula.

Mean velocity—

$$v = 8{\cdot}025\sqrt{\frac{i\,m}{{\cdot}007565}} = \sqrt{8512\,i\,m} = 92{\cdot}26\ \sqrt{i\,m}$$

$$= 92{\cdot}26\ \sqrt{18{\cdot}58\ +\ {\cdot}00005}$$

$$= 92{\cdot}26\ \sqrt{{\cdot}000929}$$

$$= 92{\cdot}26 \times {\cdot}0305 = 2{\cdot}84 \text{ feet per second.}$$

Mean velocities.

(1)	By Kutter's formula	$v = 4{\cdot}48$ feet per second.
(2)	" Prony's "	$v = 2{\cdot}89$ "
(3)	" Dupuit's "	$v = 2{\cdot}83$ "
(4)	" Chezy's "	$v = 3{\cdot}05$ "
(5)	" Humphreys & Abbot's formula	$v = 3{\cdot}95$ "
(6)	" Hagen's formula	$v = 3{\cdot}614$ "
(7)	" de Prony's with Weisbach's coefficients	$v = 2{\cdot}825$ "
(8)	" Rankine's formula	$v = 2{\cdot}814$ "
		8)26·453
	Grand mean velocity	$v = 3{\cdot}31$ "

To find the probable errors by the method of least squares, assuming each of the formulæ to have equal weights:

No. of Formula.	Velocity.	Difference from mean.	Square of Residuals.
1	4·48	−1·17	1·3689
2	2·89	+0·42	0·1764
3	2·83	+0·48	0·2304
4	3·05	+0·26	0·0676
5	3·95	−0·64	0·4096
6	3·614	−0·304	0·0924
7	2·825	+0·485	0·2352
8	2·814	+0·496	0·2461
	Mean = 3·31		$[nn_1]$ = 2·8266

Probable error:—

$$r = {\cdot}6745\sqrt{\frac{[nn_1]}{m-1}} = {\cdot}6745\sqrt{\frac{2{\cdot}8266}{8\ -\ 1}}$$

$$= {\cdot}6745\ \sqrt{{\cdot}04038} = {\cdot}6946 \times \pm 0{\cdot}63$$

$$= \pm 0\ 425 \text{ feet.}$$

Probable error of arithmetical mean:—

$$r\,(x) = \frac{{\cdot}6745}{\sqrt{m}}\sqrt{\frac{[nn_1]}{m-1}} = \frac{{\cdot}6745}{\sqrt{8}}\sqrt{\frac{2{\cdot}8266}{8-1}}$$

$$= \frac{{\cdot}6745}{2{\cdot}8284}\ \sqrt{0{\cdot}4038}$$

$$= 2385 \times \pm 0{\cdot}63 = \pm 0{\cdot}15 \text{ feet.}$$

Mean discharge, $D = 3864 \times 3{\cdot}31 = 12{,}790$ cubic feet per second.

4THLY.—Elevation of lake surface three feet above low water of November, 1895.

1.—CHANNEL IN EARTH.

CROSS-SECTION.

Width at bottom	202 feet.
Depth	25 "
Side slopes	2 horizontal to 1 vertical.
Width at water surface (101 + 50)2	302 feet.
Sectional area, $A = \frac{202\ +\ 303}{2} \times 25$	6,300 square feet.
Wetted perimeter, $\left(101\ +\ \sqrt{25^2\ +\ 50^2}\right) \times 2$	
$= \left(101\ +\ \sqrt{3125}\right) \times 2$	
$= \left(101\ +\ 56\right) \times 2$	314 feet
Hydraulic mean radius, $m = \frac{6300}{314}$	20 "

Slope, $i = 1$ in $40{,}000 = {\cdot}000025$ feet per foot linear.

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1.—Kutter's Formula.

Mean velocity—

$$r = \left\{ \frac{41{\cdot}6 + \frac{1{\cdot}811}{n} + \frac{{\cdot}00281}{i}}{1 + \left(41{\cdot}6 + \frac{{\cdot}00281}{i}\right)\frac{n}{\sqrt{m}}} \right\} \sqrt{m\,i}$$

$$= \left\{ \frac{41{\cdot}6 + \frac{1{\cdot}811}{0{\cdot}275} + \frac{{\cdot}00281}{{\cdot}00025}}{1 + \left(41{\cdot}6 + \frac{{\cdot}00281}{{\cdot}000025}\right)\frac{{\cdot}0275}{\sqrt{20}}} \right\} \sqrt{20 \times {\cdot}000025}$$

$$= \left\{ \frac{41{\cdot}6 + 65{\cdot}85 + 112{\cdot}4}{1 + \left(41{\cdot}6 + 112{\cdot}5\right)\frac{{\cdot}0275}{4{\cdot}47}} \right\} \sqrt{{\cdot}0005}$$

$$= \left(\frac{219{\cdot}85}{1 + 154 \times {\cdot}006}\right) \times {\cdot}0224$$

$$= 114 \times {\cdot}0224$$

$$= 2{\cdot}6 \text{ feet per second.}$$

2.—de Prony's Formula.

Mean velocity—

$$v = ({\cdot}0237 + 9966\, m\, i)^{\frac{1}{2}} - {\cdot}1542$$

$$= ({\cdot}0237 + 9966 \times 20 \cdot 000025)^{\frac{1}{2}} - {\cdot}1542$$

$$= ({\cdot}0237 + 4{\cdot}983)^{\frac{1}{2}} - {\cdot}1542$$

$$= \sqrt{5} - {\cdot}1542$$

$$= 2{\cdot}236 - {\cdot}1542 = 2{\cdot}08 \text{ feet per second.}$$

3.—Dupuit's Formula.

Mean velocity—

$${\cdot}0000323\, v^2 = i\,(1 + {\cdot}225\, m)$$

$$= (1 + {\cdot}225 \times 20) \times {\cdot}000025$$

$$= (1 + 4{\cdot}5) \times {\cdot}000025$$

$$= 5{\cdot}5 \times {\cdot}000025$$

$$= {\cdot}0001375$$

$$\therefore \quad v^2 = \frac{{\cdot}0001375}{{\cdot}0000323} = 4{\cdot}26$$

$$v = \sqrt{4{\cdot}26} = 2{\cdot}60\tfrac{1}{4} \text{ feet per second}$$

4.—Chezy's Formula.

Mean velocity—

$$v = c\,\sqrt{m\,i}$$

$$= 100 \quad \sqrt{20 \times {\cdot}0000{\cdot}25}$$

$$= 100 \times {\cdot}03236$$

$$= 2{\cdot}236 \text{ feet per second.}$$

5.—Humphreys and Abbot's Formula.

Mean velocity—

$$v = \left\{ \left(225 \quad \frac{m}{2} \cdot \sqrt{i} \right)^{\frac{1}{4}} - \cdot 0388 \right\}^2$$

$$= \left\{ \left(225 \times \frac{20}{2} \sqrt{\cdot 000025} \right)^{\frac{1}{4}} - \cdot 0388 \right\}^2$$

$$= \left(\sqrt[4]{11 \cdot 25} - \cdot 0388 \right)^2$$

Log. $11 \cdot 25 = 1 \cdot 0511525 \div 4$

$1 \cdot 8314 = 0 \cdot 2627881$

$v = (1 \cdot 8314 - 0 \cdot 388)^2$

$= 1 \cdot 79)^2 = 3 \cdot 024$ feet per second.

6.—Hagen's Formula.

Mean velocity—

$$v = 4 \cdot 30 \sqrt{m} \quad \sqrt[6]{i}$$

$$= 4 \cdot 39 \sqrt{20} \cdot \sqrt[6]{\cdot 00025}$$

$$= 4 \cdot 39 \times 4 \cdot 47 \times \cdot 171$$

$$= 3 \cdot 356 \text{ feet per second.}$$

7.—de Prony's with Wiesbach's Coefficients.

Mean velocity—

$$v = \left(\cdot 00024 + 8675 \ m \ i \right)^{\frac{1}{2}} - \cdot 015$$

$$= \left(\cdot 00024 + 8675 \times 20 \times \cdot 000025 \right)^{\frac{1}{2}} - \cdot 015$$

$$= \left(00024 + 4 \cdot 3375 \right)^{\frac{1}{2}} - \cdot 015$$

$$= \sqrt{4 \cdot 33774} - \cdot 015$$

$$= 2 \cdot 083 - \cdot 015$$

$$= 2 \cdot 068 \text{ feet per second.}$$

8.—Rankine's Formula.

Mean velocity—

$$v = 8 \cdot 025 \sqrt{\frac{m \ i}{\cdot 007565}} = \sqrt{8512 \ m \ i} = 92 \cdot 26 \sqrt{m \ i}$$

$$= \text{ } 0 \cdot 36 \text{ feet per second.}$$

$$= 9 \cdot 226 \sqrt{20 \times \cdot 00925} = 92 \cdot 26 \times \cdot 02236$$

$$= 2 \cdot 06 \text{ feet per second.}$$

Mean velocities.

(1) By Kutter's formula	$v = 2 \cdot 6$	feet per second.
(2) " deProny's "	$v = 2 \cdot 08$	"
(3) " Dupuit's "	$v = 2 \cdot 06$	"
(4. " Chezy's "	$v = 2 \cdot 326$	"
(5) " Humphreys and Abbot's formula	$v = 3 \cdot 204$	"
(6) " Hagan's formula	$v = 3 \cdot 356$	"
(7) " deProny's with Wiesbach's Coefficients	$v = 2 \cdot 068$	"
(8) " Rankine's formula	$v = 2 \cdot 06$	"
	8)19·664	
Grand mean velocity	$v = 2 \cdot 458$	"

To find the probable errors by the method of least squares, assuming each of the formulas to have equal weights.

No. of Formula.	Velocity.	Difference from Mean.	Square of Residuals.
1. . . .	2·6	−0·142	0·0202
2. .	2·08	+0·378	0·1429
3. .	2·06	+0·398	0·1584
4.	2·236	+0·222	0·0493
5 . .	3·204	−0·746	0·5565
6. .	3·356	−0·898	0·8064
7. .	2·068	+0·390	0·154
8.	2·06	+0·398	0·1584
	Mean = 2·458	$[nn_1]$ =	2·0442

Probable error—

$$r = \cdot 6745 \sqrt{\frac{[nn_1]}{m-1}} = \cdot 6745 \sqrt{\frac{2\cdot 0442}{8-1}}$$

$$= \cdot 6745 \sqrt{0\cdot 2920} = \cdot 6745 \times \pm 0\cdot 54$$

$$= \pm 0\cdot 36 \text{ feet per second.}$$

Probable error of arithmetical mean—

$$r\,(x) = \frac{\cdot 6745}{\sqrt{m}} \sqrt{\frac{[nn_1]}{m-1}} = \frac{\cdot 6745}{\sqrt{8}} \sqrt{\frac{2\cdot 0442}{8-1}}$$

$$= \frac{\cdot 6745}{2\cdot 8284} \sqrt{0\cdot 2920} = \cdot 2385 \times \pm 0\cdot 54$$

$$= 0\cdot 129 \text{ feet.}$$

Mean discharge, D = 6300 × 2·458 = 15,480 cubic feet per second.

5THLY.—*Elevation of lake surface four feet above low water of November, 1895.*

1ST.—CHANNEL IN EARTH.

CROSS-SECTION.

Width at bottom ..... 202 feet.
Depth ..... 26 "
Side slopes ..... 2 horizontal to 1 vertical
Width at surface (101 + 52) × 2 ..... 306 feet.

Sectional area, $A = \frac{202 + 306}{2} \times 26 = 6{,}604$ square feet

Wetted perimeter $\left(101 + \sqrt{26^2 + 52^2}\right) \times 2$

$$= \left(101 + \sqrt{3380}\right) \times 2$$

$$= (101 + 58) \times 2.$$

$$= 159 \times = 318 \text{ feet.}$$

Hydraulic means radius, $m = \frac{6604}{318} = 20\cdot 77$ feet.

Slope, $i = 1$ in $40{,}000 = \cdot 000025$ feet per foot linear.

1.—Kutter's Formula.

Mean velocity—

$$v = \left\{ \frac{41\cdot 6 + \frac{1\cdot 811}{n} + \frac{\cdot 00281}{i}}{1 + \left(41\cdot 6 + \frac{\cdot 00281}{i}\right)\frac{n}{\sqrt{m}}} \right\} \sqrt{m\,i}$$

$$= \left\{ \frac{41\cdot 6 + \frac{1\cdot 811}{\cdot 0275} + \frac{\cdot 00281}{\cdot 000025}}{1 + \left(41\cdot 6 + \frac{\cdot 00281}{\cdot 000025}\right)\frac{\cdot 0275}{\sqrt{20\cdot 77}}} \right\} \sqrt{20\cdot 77 \times \cdot 000025}$$

$$= \left\{ \frac{41\cdot 6 + 65\cdot 85 + 112\cdot 4}{1 + \left(41\cdot 6 + 112\cdot 4\right)\frac{\cdot 0275}{4\cdot 557}} \right\} \sqrt{\cdot 00052}$$

$$= \frac{219\cdot 85}{1 + \cdot 927} \times \cdot 023$$

$$= \frac{219\cdot 85 \times \cdot 023}{1\cdot 927}$$

$$= 2\cdot 62 \text{ feet per second.}$$

2.—DeProny's Formula.

Mean velocity—

$$v = \left(\cdot 0237 + 9966\ m\ i\right)^{\frac{1}{2}} - \cdot 1542$$
$$= \left(\cdot 0237 + 9966 \times 20 \cdot 77 \times \cdot 000025\right)^{\frac{1}{2}} - \cdot 1542$$
$$= \left(\cdot 0237 + 5 \cdot 175\right)^{\frac{1}{2}} - \cdot 1542$$
$$= 2 \cdot 275 - \cdot 1542$$
$$= 2 \cdot 12 \text{ feet per second.}$$

3.—Dupuit's Formula.

Mean velocity—

$$\cdot 0000323\ v^2 = i\ (1 + \cdot 225\ m)$$
$$= (1 + \cdot 225 \times 20 \cdot 77) \times \cdot 000025$$
$$= (1 + 4 \cdot 67) \times \cdot 000025$$
$$= 5 \cdot 67 \times \cdot 000025$$
$$= \cdot 000142$$
$$\therefore \quad v^2 = \left(\frac{\cdot 000142}{\cdot 0000323}\right) = 4 \cdot 4$$
$$v = 2 \cdot 1 \text{ feet per second.}$$

4.—Chezy's Formula.

$$v = c\ \sqrt{m\ i}$$
$$= 100\ \sqrt{20 \cdot 77 \times \cdot 000025}$$
$$= 100 \times \cdot 023$$
$$= 2 \cdot 3 \text{ feet per second.}$$

5.—Humphreys and Abbot's Formula.

Mean velocity—

$$v = \left\{\left(225\ \frac{m}{2}\ \sqrt{i}\right)^{\frac{1}{4}} - \cdot 0388\right\}^2$$
$$= \left\{\left(225 \times \frac{20 \cdot 77}{2}\ \sqrt{\cdot 000025}\right)^{\frac{1}{4}} - \cdot 0388\right\}^2$$
$$= \left\{\left(\frac{4673 \cdot 25 \times \cdot 005}{2}\right)^{\frac{1}{4}} - \cdot 0388\right\}^2$$
$$= \left(\sqrt[4]{11 \cdot 683} - \cdot 0388\right)^2$$

Log. $= 11 \cdot 683 = 1 \cdot 0675544 \div 4..$
$= 1 \cdot 8488 = 0 \cdot 2668886$
$v = (1 \cdot 8488 - \cdot 0388)^2 = 1 \cdot 81)^2 = 3 \cdot 27$ feet per second.

6.—Hagen's Formula.

Mean velocity—

$$v = 4 \cdot 39\ \sqrt{m}\ \sqrt[6]{i}$$
$$= 4 \cdot 39 \times 4 \cdot 557 \times \cdot 171$$
$$= 3 \cdot 42 \text{ feet per second.}$$

7.—De Prony's with Wiesbach's Coefficients.

Mean velocity—

$$v = \left(\cdot 00024 + 8675\ m\ i\right)^{\frac{1}{2}} \cdot 015$$
$$= \left(\cdot 00024 + 8676 \times 20 \cdot 77 \times \cdot 000025\right)^{\frac{1}{2}} - \cdot 015$$
$$= \sqrt{4 \cdot 5} - \cdot 015$$
$$= 2 \cdot 122 - \cdot 015$$
$$= 2 \cdot 1 \text{ feet per second.}$$

8.—Rankine's Formula.

Mean velocity—

$$v = 8{\cdot}025 \sqrt{\frac{m\,i}{{\cdot}007565}} = \sqrt{8512\,m\,i} = 92{\cdot}26 \sqrt{m\,i}$$

$$= 92{\cdot}26 \sqrt{20{\cdot}77 \times {\cdot}000025}$$

$$= 92{\cdot}26 \times {\cdot}023 = 2{\cdot}122 \text{ feet per second.}$$

Mean velocities.

(1)	By Kutter's formula	$v = 2{\cdot}62$ feet per second.
(2)	" De Prony's "	$v = 2{\cdot}12$ "
(3)	" Dupuit's "	$v = 2{\cdot}1$ "
(4)	" Chezy's "	$v = 2{\cdot}3$ "
(5)	" Humphreys and Abbot's formula	$v = 3{\cdot}276$ "
(6)	" Hagen's formula	$v = 3{\cdot}42$ "
(7)	" De Prony's with Wiesbach's coefficients	$v = 2{\cdot}1$ "
(8)	" Rankine's formula	$v = 2{\cdot}122$ "
		$8)20{\cdot}058$
	Grand mean velocity	$v = 2{\cdot}507$ "

To find the probable errors by the method of least squares, assuming each of the formulas to have equal weights :—

No. of Formula.	Velocity.	Difference from Mean.	Square of Residuals.
1	2·62	−0·113	0·0128
2	2·12	+0·387	0·1498
3	2·1	+0·407	0·1656
4	2·3	+0·207	0·0429
5	3·276	−0·769	0·5914
6	3·42	−0·873	0·7621
7	2·1	+0·407	0·1657
8	2·122	+0·385	0·1482
	Mean = 2·507		$[nn_1] = 2{\cdot}0385$

Probable error—

$$r = {\cdot}6745 \sqrt{\frac{[nn_1]}{m-1}} = {\cdot}6745 \sqrt{\frac{2{\cdot}0385}{8-1}}$$

$$= {\cdot}6745 \sqrt{0{\cdot}2912} = {\cdot}6745 \times \pm 0{\cdot}54$$

$$= \pm 0{\cdot}36 \text{ feet.}$$

Probable error of arithmetical mean—

$$r\,(x) = \frac{{\cdot}6745}{\sqrt{m}} \sqrt{\frac{[nn_1]}{m-1}} = \frac{{\cdot}6745}{\sqrt{8}} \sqrt{\frac{2{\cdot}0385}{8-1}}$$

$$= \frac{{\cdot}6745}{2{\cdot}8284} \sqrt{0{\cdot}2912} = {\cdot}2385 \times \pm 0{\cdot}54$$

$$= \pm 0{\cdot}129 \text{ feet.}$$

Mean discharge, $D = 6604 \times 2{\cdot}507 = 16{,}560$ cubic feet per second.

6THLY.—*Elevation of lake surface five feet above low water of November, 1895.*

CHANNEL IN EARTH.

Width at bottom	202 feet.
Depth	27 "
Side slopes	2 horizontal to 1 vertical.
Width at water surface	$(101 + 54) \times 2 = 310$ feet.
Sectional area	$A = \frac{202 + 310}{2} \times 27 = 6{\cdot}912$ square miles.
Wetted perimeter	$(101 + \sqrt{27^2 + 54^2}) \times 2 = 322{\cdot}75$ feet.
Hydraulic mean radius	$m = \frac{6912}{322{\cdot}75} = 21{\cdot}4$ feet.
Slope of channel	$i = 1$ in 40,000 $= {\cdot}000025$ feet per foot linear.

1.—Kutter's Formula.

$$v = \left\{ \frac{41{\cdot}6 + \frac{1{\cdot}811}{n} + \frac{{\cdot}00281}{i}}{1 + \left(41{\cdot}6 + \frac{{\cdot}00281}{i}\right)\frac{n}{\sqrt{m}}} \right\} \sqrt{m\,i}$$

$$= \left\{ \frac{41{\cdot}6 + \frac{1{\cdot}811}{{\cdot}0275} + \frac{{\cdot}00281}{{\cdot}000025}}{1 + \left(41{\cdot}6 + \frac{{\cdot}00281}{{\cdot}000025}\right)\frac{{\cdot}0275}{\sqrt{21{\cdot}4}}} \right\} \sqrt{21{\cdot}4 \times {\cdot}000025}$$

$$v = \left\{ \frac{41{\cdot}6 + 65{\cdot}85 + 112{\cdot}4}{1 + \left(41{\cdot}6 + 112{\cdot}4\right)\frac{{\cdot}0275}{4{\cdot}626}} \right\} \sqrt{{\cdot}000535}$$

$$= \left(\frac{219{\cdot}85}{1 + 154 \times \frac{{\cdot}0275}{{\cdot}4626}} \right) \sqrt{{\cdot}000535}$$

$$= \frac{219{\cdot}85}{1 + {\cdot}916} \times {\cdot}02313$$

$$= 114{\cdot}75 \times {\cdot}02313$$

$$= 2{\cdot}65 \text{ feet per second.}$$

2.—de Prony's Formula.

Mean velocity—

$$v = \left({\cdot}0237 + 9966\ m\,i\right)^{\frac{1}{2}} - {\cdot}1542$$

$$= \left({\cdot}0237 + 9966 \times 22{\cdot}4 \times {\cdot}000025\right)^{\frac{1}{2}} - {\cdot}1542$$

$$= \left({\cdot}0237 + 5{\cdot}3318\right)^{\frac{1}{2}} - {\cdot}1542$$

$$= \sqrt{5{\cdot}3555} - {\cdot}1542$$

$$= 2{\cdot}3154 - {\cdot}1542$$

$$= 2{\cdot}16 \text{ feet per second.}$$

3.—Dupuit's Formula.

Mean velocity—

$${\cdot}0000323\ v^2 = i\,(1 + {\cdot}225\ m)$$

$$= (1 + {\cdot}225 \times 21{\cdot}4) \times {\cdot}000025$$

$$= (1 + 4{\cdot}815) \times {\cdot}000025$$

$$= {\cdot}0001454$$

$$\therefore\ v^2 = \frac{{\cdot}0001454}{{\cdot}0000323} = 4{\cdot}5$$

$$v = 2{\cdot}11 \text{ feet per second.}$$

4.—Chezy's Formula

Mean velocity—

$$v = c\sqrt{m\,i}$$

$$= 100\ \sqrt{21{\cdot}4 \times {\cdot}000025}$$

$$= 100\ \sqrt{{\cdot}000535}$$

$$= 100 \times {\cdot}02313$$

$$= 2{\cdot}313 \text{ feet per second.}$$

5.—Humphreys and Abbot's Formula.

Mean velocity—

$$v = \left\{ \left(225 + \frac{m}{2}\ \sqrt{i} \right)^{\frac{1}{4}} - {\cdot}0388 \right\}^2$$

$$= \left\{ \left(225 \times \frac{21{\cdot}4}{2}\ \sqrt{{\cdot}000025} \right)^{\frac{1}{2}} - {\cdot}0288 \right\}^2$$

$$= \left(\sqrt[4]{12{\cdot}0375} - {\cdot}0388 \right)^2$$

$$\text{Log. } 12{\cdot}038 = 1{\cdot}0805543 \div 4$$

$$1{\cdot}8628 = 0{\cdot}2701386$$

$$\therefore\ v = (1{\cdot}8628 - {\cdot}0388)^2$$

$$= 1{\cdot}824)^2$$

$$= 3{\cdot}327 \text{ feet per second.}$$

6.—Hagen's Formula.

Mean velocity—

$$v = 4{\cdot}39 \sqrt{m} \sqrt[6]{i}$$

$$= 4{\cdot}39 \times \sqrt{21{\cdot}4} \sqrt[6]{{\cdot}000025}$$

$$= 4{\cdot}39 \times 4{\cdot}626 \times {\cdot}171$$

$$= 3{\cdot}473 \text{ feet per second.}$$

7.—de Prony's with Wiesbach's Coefficients.

Mean velocity—

$$v = \left({\cdot}00024 + 8675\ m\,i\right)^{\frac{1}{2}} - {\cdot}015$$

$$= \left({\cdot}00024 + 8675 \times 21{\cdot}4 \times {\cdot}000025\right)^{\frac{1}{2}} - {\cdot}015$$

$$v = \left({\cdot}00024 + 6{\cdot}6414\right)^{\frac{1}{2}} - {\cdot}015$$

$$= \sqrt{4{\cdot}6414} - {\cdot}015 = 2{\cdot}154 - {\cdot}015$$

$$= 2{\cdot}14 \text{ feet per second.}$$

8.—Rankine's Formula.

Mean velocity—

$$v = 8{\cdot}025 \sqrt{\frac{m\,i}{{\cdot}007565}} = \sqrt{8512\ m\,i} = 92{\cdot}26 \sqrt{m\,i}$$

$$= 92{\cdot}26 \sqrt{21{\cdot}4 \times {\cdot}000025}$$

$$= 92{\cdot}26 \sqrt{{\cdot}00535}$$

$$= 92{\cdot}26 \times {\cdot}02315$$

$$= 2{\cdot}136 \text{ feet per second.}$$

Mean velocities.

1. By Kutter's formula.....	$v = 2{\cdot}65$	feet per second.
2. " de Prony's " ...	$v = 2{\cdot}16$	"
3. " Dupuit's " ...	$v = 2{\cdot}11$	"
4. " Chezy's "	$v = 2{\cdot}313$	"
5. " Humphreys and Abbot's formula...	$v = 3{\cdot}327$	"
6. " Hagen's formula.....	$v = 3{\cdot}473$	"
7. " de Prony's with Wiesbach's Co-efficients.	$v = 2{\cdot}14$	"
8. " Rankine's formula.....	$v = 2{\cdot}136$	"
	$8)\ 20{\cdot}309$	"
Grand mean velocity...	$v = 2{\cdot}538$	"

To find the probable errors by the method of least squares, assuming each of the formulas to have equal weights.

Number of Formula.	Velocity.	Difference from Mean.	Square of Residuals.
1..	2·65	−0·112	0·0125
2..	2·16	+0·378	0·1429
3..	2·11	+0·428	0·1832
4..	2·313	+0·225	0·0506
5..	3·327	−0·789	0·6225
6..	3·473	−0·935	0·8742
7..	2·14	+0·398	0·1584
8..	2·136	+0·402	0·1616
	Mean = 2·538		$[n\ n_1] = 2{\cdot}2059$

Probable error—

$$r\,(x) = \cdot 6745 \sqrt{\frac{[nn_1]}{m-1}} = \cdot 6745 \sqrt{\frac{2 \cdot 2059}{8-1}}$$

$$= \cdot 6745 \sqrt{0 \cdot 3123} = \cdot 6745 \times \pm 0 \cdot 56$$

$$= + 0 \cdot 38 \text{ feet.}$$

Probable error of Arithmetical Mean—

$$r\,(x) = \frac{\cdot 6745}{\sqrt{m}} \sqrt{\frac{[nn_1]}{m-1}} = \frac{\cdot 6745}{\sqrt{8}} \sqrt{\frac{2 \cdot 2059}{8-1}}$$

$$= \frac{\cdot 6745}{2 \cdot 8284} \sqrt{0 \cdot 3123} = \cdot 2385 \times \pm 0 \cdot 56$$

$$= \div 0 \cdot 133 \text{ feet.}$$

Mean Discharge, D = 6912 × 2·538 = 17,540 cubic feet per second.

The section of the channel in earth extends from Robey Street junction 13·15 miles or 69,432 feet. The fall in this distance, at ·000025 feet per foot linear, is 1·75 feet nearly.

2ND.—CHANNEL IN ROCK.

CROSS-SECTION.

Width at bottom..... 160 feet.
Width at water surface . ..... 162 "
Mean width..... 161 "
Depth..... 23·75 "
Sectional area .. $A = 161 \times 23 \cdot 75 = 3823 \cdot 75$ square feet.
Wetted perimeter. $160 \times 23 \cdot 75 = 207 \cdot 5$ feet.

Hydraulic mean radius. $m = \frac{3823 \cdot 75}{207 \cdot 5} = 18 \cdot 42$ "

Slope..... $i = 1$ in 20,000 = ·00005 feet per foot linear.

1.—Kutter's Formula.

Co-efficient of roughness, n = ·017; same as for rubble.

Mean velocity—

$$v = \left\{ \frac{41 \cdot 6 + \frac{1 \cdot 811}{n} + \frac{\cdot 00281}{i}}{1 + \left(41 \cdot 6 + \frac{\cdot 00281}{i}\right) \frac{n}{\sqrt{m}}} \right\} \sqrt{m\,i}$$

$$= \left\{ \frac{41 \cdot 6 + \frac{1 \cdot 811}{\cdot 017} + \frac{\cdot 00281}{\cdot 00005}}{1 + \left(41 \cdot 6 + \frac{\cdot 00281}{\cdot 00005}\right) \frac{\cdot 017}{\sqrt{18 \cdot 42}}} \right\} \sqrt{18 \cdot 42 \times \cdot 00005}$$

$$= \left\{ \frac{41 \cdot 6 + 106 \cdot 5 + 56 \cdot 2}{1 + (41 \cdot 6 + 56) \frac{\cdot 017}{4 \cdot 29}} \right\} \sqrt{\cdot 000951}$$

$$= \left(\frac{204 \cdot 3}{1 + 97 \cdot 6 + \cdot 004} \right) \times \cdot 0303$$

$$= \frac{204 + \cdot 0303}{1 + 39} = \frac{6 \cdot 19}{1 \cdot 39}$$

$$= 4 \cdot 455 \text{ feet per second.}$$

2.—de Prony's Formula.

Mean velocity—

$$v = \left(\cdot 0237 + 9966\, mi\right)^{\frac{1}{2}} - \cdot 1542$$

$$= \left(\cdot 0237 + 9966 + 18 \cdot 42 + \cdot 00005\right)^{\frac{1}{2}} - \cdot 1542$$

$$= \left(\cdot 0237 + 9 \cdot 1787\right)^{\frac{1}{2}} - \cdot 1542$$

$$= \sqrt{9 \cdot 2024} - \cdot 1542 = 3 \cdot 0335 - \cdot 1542$$

$$= 2 \cdot 879 \text{ feet per second.}$$

3.—Dupuit's Formula.

Mean velocity—

$$\cdot 0000323\ v^2 = i\ (1 + \cdot 225\ m)$$
$$= (1 + \cdot 225 \times 18 \cdot 42) \times \cdot 00005$$
$$= (1 + 4 \cdot 145) \times 00005 = \cdot 0008725$$
$$\therefore\ v^2 = \frac{\cdot 00025725}{\cdot 0000323} = 8$$
$$v = 2 \cdot 83 \text{ feet per second.}$$

3.—Chezy's Formula.

Mean velocity—

$$v = c\ \sqrt{m\ i}$$
$$= 100\ \sqrt{18 \cdot 42 \times \cdot 00005}$$
$$= 100 \times \cdot 0303$$
$$= 3 \cdot 03 \text{ feet per second.}$$

5.—Humphreys and Abbot's Formula.

Mean velocity—

$$v = \left\{ \left(225 \frac{m}{2}\ \sqrt{i} \right)^{\frac{1}{4}} - \cdot 0388 \right\}^2$$
$$= \left\{ \left(225 \times \frac{18 \cdot 42}{2}\ \sqrt{\cdot 00005} \right)^{\frac{1}{4}} - \cdot 0388 \right\}^2$$
$$= \left\{ \left(225 \times 9 \cdot 21 \times \cdot 007 \right)^{\frac{1}{4}} - \cdot 0388 \right\}^2$$
$$= \left(\sqrt[4]{14 \cdot 5} - \cdot 0388 \right)^2 = (1 \cdot 95 - \cdot 0388)^2$$
$$= \left(\overline{1 \cdot 91} \right)^2 = 3 \cdot 648 \text{ feet per second.}$$

6.—Hagen's Formula.

Mean velocity—

$$v = 4 \cdot 39\ \sqrt{m}\ \sqrt[6]{i}$$
$$= 4 \cdot 39\ \sqrt{18 \cdot 42}\ .\ \sqrt[6]{\cdot 00005}$$
$$= 4 \cdot 39 \times 4 \cdot 29 \times \cdot 191$$
$$= 3 \cdot 597 \text{ feet per second.}$$

7.—de Prony's with Wiesbach's Coefficients.

Mean velocity—

$$v = (\cdot 00024 + 8675\ mi)^{\frac{1}{2}} - \cdot 015$$
$$= (\cdot 00024 + 9675 \times 18 \cdot 42 \times \cdot 00005)^{\frac{1}{2}} - \cdot 015$$
$$= (\cdot 00024 + 7 \cdot 98968)^{\frac{1}{2}} - \cdot 015$$
$$= \sqrt{7 \cdot 98992} - \cdot 015$$
$$= 2 \cdot 827 - \cdot 015$$
$$= 2 \cdot 812 \text{ feet per second.}$$

8.—Rankine's Formula.

Mean velocity—

$$r = 8 \cdot 025 \sqrt{\frac{i\ m}{\cdot 007565}} = \sqrt{8512\ i\ m} = 92 \cdot 26\ \sqrt{i\ m}$$
$$= 92 \cdot 26\ \sqrt{18 \cdot 42 \times \cdot 00005}$$
$$= 92 \cdot 26\ \sqrt{\cdot 000921}$$
$$= 92 \cdot 26 \times \cdot 0303$$
$$= 2 \cdot 796 \text{ feet per second.}$$

Mean velocities.

(1)	By Kutter's formula.	$v = 4{\cdot}445$ feet per second.
(2)	" de Prony's "	$v = 2{\cdot}879$ "
(3)	" Dupuit's "	$v = 2{\cdot}83$ "
(4)	" Chezy's "	$v = 3{\cdot}03$ "
(5)	" Humphreys and Abbot's formula...	$v = 3{\cdot}648$ "
(6)	" Hagen's formula.....	$v = 3{\cdot}597$ "
(7)	" de Prony's with Wiesbach's coefficients...	$v = 2{\cdot}812$ "
(8)	" Rankine's formula.....	$v = 2{\cdot}796$ "
		8)26·047
	Grand mean velocity.....	$v = 3{\cdot}256$ "

To find the probable errors by the method of least squares, assuming each of the formulas to be of equal weights.

Number of Formula.	Velocity.	Difference from Mean.	Square of Residuals.
1...	4·455	−1·199	1·4376
2..	2·879	+0·377	0·1421
3..	2·83	+0·426	0·1815
4..	3·03	+0·226	0·0511
5..	3·648	−0·392	0·1537
6..	3·597	−0·341	0·1163
7..	2·812	+0·444	0·1971
8....	2·796	+0·460	0·2116
	Mean = 3·256		$[n\,n_1]$ = 2·4910

Probable errors—

$$r = \cdot6745\sqrt{\frac{[nn_1]}{m-1}} = \cdot6745\sqrt{\frac{2{\cdot}4910}{8-1}}$$

$$= \cdot6745\ \sqrt{0{\cdot}3560} = \cdot6745 \times \pm 0{\cdot}59$$

$$= +0{\cdot}398 \text{ feet.}$$

Probable error of arithmetical mean—

$$r = (x)\frac{\cdot6745}{\sqrt{m}}\sqrt{\frac{[nn_1]}{m-1}} = \frac{\cdot6745}{\sqrt{8}}\sqrt{\frac{2{\cdot}4910}{8-1}}$$

$$= \frac{\cdot6745}{2{\cdot}8284}\ \sqrt{\cdot3560} = \cdot2385 \times \pm 0{\cdot}59$$

$$= \pm 0{\cdot}14 \text{ feet.}$$

Mean discharge ..... D = 3824·75 × 3·256 = 12,460 cubic feet per second.
Mean discharge D in earth channel with water 22 feet deep = 12,448 cubic feet per second.

Hence, the contracted channel in rock, with a head of 23·75 feet, discharges the same quantity as the larger channel in earth with a depth of 22 feet. In other words, the contraction causes an elevation of the water surface of 1·75 feet at the point of contraction, or the junction of the earth and rock channels.

1st.—CHANNEL IN EARTH.

The elevation of mean lake level of Lake Michigan over the monthly mean level of November, 1895, has been 2·6 feet.

To find the discharge of the Chicago Channel at that elevation.

CROSS-SECTION.

Width at bottom..... 202 feet.
Depth..... 24·6 "
Side slopes—2 horizontal to 1 vertical—
Width at surface..... (101 + 49·2) × 2 = 300·4 feet.

Sectional area..... $A = \frac{202 + 303{\cdot}4}{2} \times 24{\cdot}6 = 6179{\cdot}52$ square "

Wetted perimeter..... $= (101 + \sqrt{24{\cdot}6^2 + 49{\cdot}2^2}) \times 2$

$= (101 + 55) \times 2$

$= 156 \times 2 = 312$ feet.

Hydraulic mean radius..... $m = \frac{6179{\cdot}52}{312} = 19{\cdot}8$ feet.

Slope of channel..... $i = \frac{1}{40000} = \cdot000025$ feet per foot linear.

1.—Kutter's Formula.

Mean velocity—

$$v = \left\{ \frac{41{\cdot}6 + \frac{1{\cdot}811}{n} + \frac{{\cdot}00281}{i}}{1 + \left(41{\cdot}6 + \frac{{\cdot}00281}{i}\right)\frac{n}{\sqrt{m}}} \right\} \sqrt{m\,i}$$

$$v = \left\{ \frac{41{\cdot}6 + \frac{1{\cdot}811}{{\cdot}0275} + \frac{{\cdot}00281}{{\cdot}000085}}{1 + \left(41{\cdot}6 + \frac{{\cdot}00281}{{\cdot}000025}\right)\frac{{\cdot}0275}{\sqrt{19{\cdot}8}}} \right\} \sqrt{19{\cdot}8 \times {\cdot}000025}$$

$$= \left\{ \frac{41{\cdot}6 + 65{\cdot}85 + 112{\cdot}4}{1 + \left(41{\cdot}6 + 112{\cdot}4\right)\frac{{\cdot}0275}{\sqrt{4{\cdot}45}}} \right\} \sqrt{{\cdot}000495}$$

$$= \left(\frac{219{\cdot}85}{1 + 154 + \frac{{\cdot}0275}{4{\cdot}45}} \right) \times {\cdot}02225$$

$$= \left(\frac{219{\cdot}85}{1 + 154 + {\cdot}00618} \right) \times {\cdot}02225$$

$$= \frac{219{\cdot}85 \times {\cdot}02225}{1 + {\cdot}954}$$

$$= \frac{4{\cdot}89}{1{\cdot}954} = 2{\cdot}5 \text{ feet per second.}$$

2.—de Prony's Formula.

Mean velocity—

$$v = \left({\cdot}0237 + 9966\,m\,i\right)^{\frac{1}{2}} - {\cdot}1542$$

$$= \left({\cdot}0237 + 9966 \times 19{\cdot}8 \times {\cdot}000025\right)^{\frac{1}{2}} - {\cdot}1542$$

$$= \left({\cdot}0237 + 9966 \times {\cdot}000495\right)^{\frac{1}{2}} - {\cdot}1542$$

$$= \left({\cdot}0235 \times 4{\cdot}9332\right)^{\frac{1}{2}} - {\cdot}154$$

$$= 2{\cdot}227 - {\cdot}1542$$

$$= 2{\cdot}073 \text{ feet per second.}$$

3.—Dupuit's Formula.

Mean velocity—

$${\cdot}0000323\,v^2 = i\,(1 + {\cdot}225\,m)$$

$$= (1 + {\cdot}225 \times 19{\cdot}8) \times 000025$$

$$= (1 + 4{\cdot}455) \times {\cdot}000025$$

$$= {\cdot}0001364$$

$$\therefore\ v^2 = \frac{{\cdot}0001364}{{\cdot}0000323} = 4{\cdot}223$$

$$v = \sqrt{4{\cdot}223} = 2{\cdot}025 \text{ feet per second.}$$

4.—Chezy's Formula.

Mean velocity—

$$v = c\,\sqrt{m\,i}$$

$$= 100\,\sqrt{19{\cdot}8 \times {\cdot}000025}$$

$$= 100\,\sqrt{{\cdot}000495}$$

$$= 100 \times {\cdot}02225$$

$$= 2{\cdot}225 \text{ feet per second.}$$

5.—Humphreys and Abbot's Formula.

Mean velocity—

$$c = \left\{\left(225\frac{m}{2}\sqrt{i}\right)^{\frac{1}{2}} - \cdot0388\right\}^2$$

$$= \left\{\left(225 \times \frac{19\cdot8}{2}\sqrt{\cdot000025}\right)^{\frac{1}{2}} - \cdot0388\right\}^2$$

$$= \left\{\left(225 \times 9\cdot9 \times \cdot005\right)^{\frac{1}{2}} - \cdot0388\right\}^2$$

$$= \left(\sqrt[4]{11\cdot137} - 0388\right)^2 = (1\cdot827 - \cdot0388)^2$$

$$= 1\cdot788)^2 = 3\cdot19 \text{ feet per second.}$$

6.—Hagen's Formula.

Mean velocity—

$$v = 4\cdot39\sqrt{m}\ \sqrt[6]{i}$$

$$= 4\cdot39\ \sqrt{19\cdot8}\ .\ \sqrt[6]{\cdot000025}$$

$$= 4\cdot39 \times 4\cdot45 \times \cdot171$$

$$= 3\cdot341 \text{ feet per second.}$$

7.—deProny's with Wiesbach's Coefficients.

Mean velocity—

$$v = (\cdot0024 + 9675\ mi)^{\frac{1}{2}} - \cdot013$$

$$= (\cdot00024 + 8676 \times 19\cdot9 \times \cdot000025) - \cdot015$$

$$= (\cdot00024 + 4\cdot29413)^{\frac{1}{2}} - \cdot015$$

$$= \sqrt{5\cdot29437} - \cdot015$$

$$= 2\cdot072 - \cdot015$$

$$= 2\cdot057 \text{ feet per second.}$$

8.—Rankine's Formula.

Mean velocity—

$$v = 8\cdot025\sqrt{\frac{m\,i}{\cdot007565}} = \sqrt{8512\ m\ i} = 92\cdot26\ \sqrt{m}$$

$$= 92\cdot26\ \sqrt{18\cdot8 \times \cdot000025}$$

$$= 92\cdot26 \times \cdot02225$$

$$= 2\cdot053 \text{ feet per second.}$$

Mean velocities.

1.	By Kutter's formula	$v = 2\cdot5$	feet per second.
2.	" de Prony's "	$v = 2\cdot073$	"
3.	" Dupuit's "	$v = 2\cdot055$	"
4.	" Cheny's "	$v = 2\cdot225$	"
5.	" Humphreys and Abbot's formula	$v = 3\cdot197$	"
6.	" Hagen's formula	$v = 3\cdot341$	"
7.	" de Prony's with Wiesbach's Coefficients	$v = 2\cdot057$	"
8.	" Rankine's formula	$v = 2\cdot053$	"
		8)19·501	
	Grand mean velocity	$v = 2\cdot438$	"

To find the probable errors by the method of least squares, assuming each of the formulæ to have equal weights.

Number of Formula.	Velocity.	Difference from Mean.	Square of Residuals.
1...	2·5	−0·062	0·0038
2...	2·073	+0·365	0·1322
3...	2·055	+0·383	0·1467
4...	2·225	+0·213	0·0454
5...	3·197	−0·759	0·5761
6...	3·341	−0·901	0·8118
7...	2·057	+0·381	0·1452
8...	2·053	+0·385	0·1482
	Mean = 2·438		$[n\ n_1] = 2·0104$

Probable error—

$$r = ·6745\sqrt{\frac{[nn_1]}{m-1}} = ·6745\sqrt{\frac{2·0104}{8-1}}$$

$$= ·6745\ \sqrt{0·2872} = 6·745 \times \pm 0·53$$

$$= +0·36 \text{ feet.}$$

Probable error of Arithmetical Mean—

$$r\ (x) = \frac{·6745}{\sqrt{m}}\sqrt{\frac{[nn_1]}{m-1}} = \frac{·6745}{\sqrt{8}}\sqrt{\frac{2·0104}{8-1}}$$

$$= \frac{·6745}{2·8284}\ \sqrt{0·2872} = ·2385 \times \pm 0·53$$

$$= \pm 0·126 \text{ feet.}$$

Mean discharge..... $D = 6179·52 \times 2·438 = 15,066$ cubic feet per second.

RECAPITULATION.

Discharge of Chicago Drainage Channel with a

Depth of 22 feet..	.....	12,448	cubic feet per second.
" 23 "	.....	13,460	" "
" 24 "	.....	14,400	" "
" 24·6 "	.....	15,066..	" "
" 25 "	.....	15,480	" "
" 26 "	.....	16,560	" "
" 27 "	.....	17,540	" "

THE ELEVATION OF BACKWATER CAUSED BY CHANNEL CONTRACTION.

Let

Y = Elevation of water surface immediately behind the contracted channel. In this case = 1·75 feet.

y = Elevation at any other point up stream.

i = Slope of bottom of uncontracted channel or pond.

s = Distance up stream from the point of contraction. In this case at Robey Street junction = 70,000 feet.

1.—Guilhelm's Formula.

$$y = Y\sqrt[3]{\frac{1}{1+\frac{1}{3}Y\left(\frac{i\,s}{Y}\right)^2} + \left(\frac{i\,s}{Y}\right)^3} - i\,s$$

$$= 1·75\sqrt[3]{\frac{1}{1+\frac{1}{3}\times 1·75\left(\frac{·000025\times 70,000}{1·75}\right)^2} + \left(\frac{·000025\times 70,000}{1·75}\right)^3}$$

$$- ·000025 \times 70,000$$

$$= 1·75\sqrt[3]{\frac{1}{1+35\times 1} + 1} - 1·75$$

$$= 1·75\sqrt[3]{\frac{1}{1·35} + 1} - 1·75 = 1·75\ \sqrt[3]{·74 - 1} - 1·75$$

$$= 1·75\ \sqrt[3]{1·74} - 1·75$$

Log. 1·74 = 0·2405492 ÷ 3 = 0·0801813 = 1·2

$\therefore y = 1·75 \times 1·2 - 1·75 = 2·1 - 1·75 = 0·35$ feet. Height of backwater at Robey Street Junction.

2.—Funk's Formula.

$$y = 2Y - \left\{ is + \sqrt{Y\left(Y - \tfrac{1}{2} is\right)} \right\}$$

$$= 2 \times 1{\cdot}75 - \left\{ {\cdot}000025 \times 70{,}000 + \sqrt{1{\cdot}75\ (1{\cdot}75 - \tfrac{1}{2}\ {\cdot}000025 \times 70{,}000} \right\}$$

$$= 3{\cdot}5 - \left\{ 1{\cdot}75 + \sqrt{1{\cdot}75\ (1{\cdot}75 - 5 \times 1{\cdot}75} \right\}$$

$$= 3{\cdot}5 - \left\{ 1{\cdot}75 + \sqrt{1{\cdot}75\ (1{\cdot}75 - {\cdot}875} \right\}$$

$$= 3{\cdot}5 - \left\{ 1{\cdot}75 + \sqrt{1{\cdot}75 + {\cdot}875} \right\}$$

$$= 3{\cdot}5 - \left\{ 1{\cdot}75 + \sqrt{1{\cdot}53125} \right\}$$

$$= 3{\cdot}5 - (1{\cdot}75 + 1{\cdot}25)$$

$$= 3{\cdot}5 - 3$$

$= 0{\cdot}5$ feet. Elevation of backwater at Robey St. junction.

3.—Poiree's Formula.

$$y = Y - is + \left(\frac{is}{4\ Y} \right)^2$$

$$= 1{\cdot}75 - 1{\cdot}75 + \left(\frac{1{\cdot}75}{4 + 1{\cdot}75} \right)^2$$

$$= 1{\cdot}75 - 1{\cdot}75 + \frac{3{\cdot}0625}{7}$$

$= {\cdot}4375$ feet. Height of backwater at Robey Street junction.

4.—Dupuit's Formula.

$\text{Log } y = \text{log } Y - \dfrac{is}{{\cdot}77\ P}$; in which P is the mean depth between the points.

$$\text{Log } y = \text{log } 1{\cdot}75 - \frac{{\cdot}000025 \times 70000}{{\cdot}77 \times 23}$$

Reduced to inches gives—

$$\text{Log } 12\,y = \text{log } 21 - \frac{1{\cdot}75}{1{\cdot}77}$$

$$= 1{\cdot}3222193 = 0{\cdot}3222193$$

$$\therefore \quad y = \frac{0{\cdot}3222193}{12} = 0{\cdot}027 \text{ feet.}$$ Height of backwater at Robey Street junction.

(1) By Guilhelm's formula	$y =$	0·35 feet.
(2) By Funk's "	$y =$	0·5 "
(3) By Poiree's "	$y =$	0·437 "
(4) By Dupuit's "	$y =$	0·027 "
		4)1·314
Mean height.	$y =$	0·3285 "

To find the probable errors by the method of least squares, assuming each of the formulas to have equal weights.

No. of Formula.	Depth of Backwater	Difference from Mean.	Square of Residuals.
1	0·35	−0·021	0·0004
2	0·5	−0·171	0·0292
3	0·437	−0·108	0·0117
4	0·027	+0·301	0·0906
	Mean = 0·3285		$[nn_1]$ = 0·1319

Probable error:—

$$r = {\cdot}6745 \sqrt{\frac{[nn_1]}{m-1}} = {\cdot}6745 \sqrt{\frac{0{\cdot}1319}{4-1}}$$

$$= 6745 \sqrt{0{\cdot}044} = {\cdot}6745 \times \pm 0{\cdot}21$$

$= \pm 0{\cdot}14$ feet.

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Probable error of arithmetical mean:—

$$r\,(x) = \frac{\cdot 6745}{\sqrt{m}}\sqrt{\frac{[nn_1]}{m-1}} = \frac{\cdot 6745}{\sqrt{4}}\sqrt{\frac{0\cdot 1319}{4-1}}$$

$$= \frac{\cdot 6745}{2}\sqrt{0\cdot 044} = \cdot 3372 \times \pm 021$$

$$= \div\ 0\cdot 071 \text{ feet.}$$

TANK ILLUSTRATIONS.

Suppose a tank 5 feet long and 2 feet wide, with a depth of water of 10 feet, receives a constant supply of 3 cubic feet per second, what will be the diameter of a round orifice in the bottom capable, with a constant head of 10 feet, to discharge 3 cubic feet per second ?

Let D = Discharge in cubic feet per second.
h = Depth of water or constant head.
A = Area of orifice in square feet.
c = Co-efficient of discharge.

By Rankine's Formula.

$$D = 8\cdot 025\, c\, A\, \sqrt{h}$$

$$= 8\cdot 025 \times \cdot 618\, A\, \sqrt{10}$$

$$= 8\cdot 025 \times \cdot 618 \times 3\cdot 16\, A$$

$$= 15\cdot 67\, A$$

$$\therefore \quad A = \frac{D}{15\cdot 67} = \frac{3}{15\cdot 67}$$

$$= \cdot 1915 \text{ square feet.}$$

Let x = duameter of orifice in feet.

Then—

$$\cdot 7854\, x^2 = \cdot 1915$$

$$\therefore \quad x^2 = \frac{\cdot 1915}{\cdot 7854} = \cdot 2439$$

$$x = \sqrt{\cdot 2439} = \cdot 494 \text{ feet.}$$

$$= 58\cdot 84 \text{ inches.}$$

2ndly. Suppose now a second orifice, made in the bottom of the tank, capable of discharging ·2 cubic feet per second at a like head of pressure; what would be the diameter of the orifice?

Let the same formula and notation be used.

A^1 = area of second orifice.

Then—

$$A' = \frac{D}{15\cdot 67} = \frac{\cdot 2}{15\cdot 67} = \cdot 01277 \text{ square feet.}$$

Let x^1 = diameter of less orifice.

Then—

$$\cdot 7854\, x'^2 = 01277$$

$$\therefore \quad x' = \frac{\cdot 01277}{\cdot 7854} = \cdot 0164$$

$$x' = \sqrt{\cdot 0164} = \cdot 128 \text{ feet} = 1\cdot 54 \text{ inches.}$$

Suppose now, with a constant supply of three cubic feet, both orifices are opened, discharging 3·2 cubic feet per second, the problem is to find how much the level of the tank must fall to establish equilibrium between influx and efflux.

At first blush, one would be led to infer that, with the outflow in excess of the inflow, the tank would eventually be drained of all its contents. But this is not so, as the following computation demonstrates:

Let h^1 = equal the depth of the water in the tank or new head of pressure to maintain equilibrium of supply and discharge.

Then

$$D = 8{\cdot}025\ c(A + A_1)\ \sqrt{h_1}$$
$$= 8{\cdot}024 \times {\cdot}618\ ({\cdot}1915 + {\cdot}01277)\ \sqrt{h_1}$$
$$= 8{\cdot}025 \times {\cdot}618 \times {\cdot}2043\ \sqrt{h_1}$$
$$= 1{\cdot}0133\ \sqrt{h_1}$$

Square both sides.

Then

$$D^2 = \overline{1{\cdot}0133}^2\ h_1$$
$$h_1 = \left(\frac{1{\cdot}0133}{D}\right)^2 = \left(\frac{3}{1{\cdot}0133}\right)^2$$
$$= \overline{2{\cdot}96}^2 = 8{\cdot}76 \text{ feet.}$$

∴to maintain equilibrium, there would be a depression in the water surface of the tank of 1·24 feet; and it would remain at this elevation while the conditions of the problem remained unchanged.

Suppose, now, that we plug up both orifices in the bottom of the tank, and substitute an orifice or outlet at the surface, and, for simplicity of calculation, call it a rectangular notch extending upward to the top of the tank. Let the other conditions of the problem remain the same, viz., a constant influx and efflux of three cubic feet per second.

Assuming the notch to be two feet in width, what will be its depth from the surface of the water to the sill to discharge 3 cubic feet per second?

Let b = the width, while the rest of the notation remains the same as above.

By Rankine's Formula, the discharge

$$D = 8{\cdot}025\ c \times \tfrac{2}{3}\ b\ h_1^{\frac{3}{2}}$$
$$= 5{\cdot}35 \times {\cdot}5 \times 2\ h_1^{\frac{3}{2}}$$
$$= 5{\cdot}35\ h_1^{\frac{3}{2}}$$
$$\therefore \quad = h_1^{\frac{2}{3}}\ \frac{D}{5{\cdot}35}$$
$$= \frac{3}{5{\cdot}35} = {\cdot}56$$

Squaring both sides.

$$h^3 = {\cdot}56^2$$
$$h_1 = 56^{\frac{2}{3}}$$
$$\log.\ 56 = 1\ {\cdot}7481880 \times \tfrac{2}{3}$$
$${\cdot}68 = 1\ {\cdot}8221353.$$
$${\cdot}68 \text{ feet} = 8{\cdot}16 \text{ inches.}$$

Again, suppose that a second rectangular notch is made in the tank capable of discharging ·2 cubic feet per second, with the sill of both orifices or notches at the same elevation; what will be the width, b_1, of the second orifice?

Using the same notation and formula—

$$D = 8{\cdot}025\ c \times \tfrac{2}{3} h_1 h_1^{\frac{2}{3}}$$
$$= 5{\cdot}35 \times {\cdot}5 \times {\cdot}56\ b_1$$
$$= 1{\cdot}498\ b_1$$
$$b_1 = \frac{D}{1{\cdot}498} = \frac{{\cdot}2}{1{\cdot}498}$$
$$= {\cdot}1335 \text{ feet} = 1{\cdot}6 \text{ inches.}$$

Next to find the height of the surface of the water in the tank above the sill of the notch, when the two orifices or notches will discharge 3 cubic feet per second, that is to say, when the equilibrium between influx and efflux is again restored?

Let x be the difference of elevation between the original depth of water on the sill when the one notch is discharging 3 cubic feet per second, and that when the two notches are discharging 3·2 cubic feet per second.

Then $h_1 - x$ will be the depth of water on the sill when equilibrium is again established between inflow and outflow.

Call b_1 = combined width of both notches, the other notation remaining the same.

Then

$$\begin{aligned} D &= 8{\cdot}025\, c \times \tfrac{2}{3} h_1 h_1^{\frac{3}{2}} \\ &= 5{\cdot}35 \times {\cdot}5 \times 2{\cdot}1335\, h_1^{\frac{5}{2}} \\ &= 5{\cdot}707\, h_1^{\frac{5}{2}} \\ \therefore h_1^{\frac{5}{2}} &= \frac{D}{5{\cdot}707} \\ &= \frac{3}{5{\cdot}707} \\ &= {\cdot}52567 \end{aligned}$$

Squaring both sides

$$h_1^3 = \left(\cdot 52567\right)^2$$

$$h_1 = \left(\cdot 52567\right)^{\frac{2}{3}}$$

$$\log. {\cdot}52567 = 1{\cdot}7207132 \times \tfrac{2}{3}$$

$$= {\cdot}65 = 1{\cdot}8138088$$

Hence, $x = {\cdot}68 - {\cdot}65 = {\cdot}03$ feet

$= {\cdot}36$ inches.

This is the depression in the water surface of the tank necessary to maintain equilibrium between influx and efflux.

When the sills of the notches are at different elevations, the problem becomes more complicated, involving a cubic equation for the value of x. While the roots of the equation could be calculated by "Taylor's Theorem," it has not been deemed necessary for purposes of this illustration to pursue it any further.

In the above illustrations, it will be observed that the discharge of the smaller notch or orifice is 1 : 15 of the capacity of the larger. This ratio has been assumed as that of the Chicago drainage channel to that of Lake Huron Michigan by its natural outlet, the St. Clair river.

LEVELS OF THE GREAT LAKES.

The plane of reference of the water level curves of Lake Erie, adopted by the Lake Survey, is the supposed high water of 1838. It is 575·2 feet above mean tide in New York harbour. With this plane of reference as zero, mean level of surface of the lake from 1860 to 1875 is—2·34 feet. This latter, which is 572·86 feet above mean tide, New York, is the zero of the United States gauge at Buffalo harbour. The mean monthly level of Lake Erie for the month of November, 1895, at Cleveland, Ohio, has been $-4{\cdot}41$ feet, equivalent to $-2{\cdot}07$ feet on the Buffalo gauge.

For the discharge measurements of the Niagara river, taken in December, 1891, and in April and May, 1892 (see annual report of the Chief of Engineers, U. S. Army, for 1893, p. 4364 *et sequitur*), the relation of the Buffalo gauge to the local gauge at the discharge cross-section is expressed by the following equation:—

Local gauge height = $2{\cdot}087 + 0{\cdot}624\, x - 0{\cdot}046\, x^2$ + &c., in which x = height of Buffalo gauge in feet, − + indicating above zero, and − below.

$$-2{\cdot}07 \text{ feet Buffalo gauge} = 2{\cdot}087 + 0{\cdot}624 \times (-207) - 0{\cdot}046 \times \left(-2{\cdot}07\right)^2 + \&c.$$

$$= 2{\cdot}087 - 1{\cdot}292 - 0{\cdot}197 = 0{\cdot}598$$

The discharge given on the smooth curve of discharge for 0·6 feet on local gauge is 190,000 cubic feet per second.

Assuming that 85 per cent of this efflux passed through the St.Clair River at the foot of Lake Huron, gives $190{,}000 \times \cdot 85 = 161 \cdot 500$ cubic feet per second, the discharge for Lake Huron. At a corresponding stage of Lake Michigan, the Chicago drainage channel will discharge, as shown above (p. 13) 12,500 cubic feet per second.

Assuming like conditions as in our tank illustrations, that is to say, a rectangular outlet at Port Huron, 2,000 feet in width.

1st. What would be the depth (mean) to discharge 161,500 cubic feet per second?

By Rankine's formula above—

$$D = 8 \cdot 025 c \times \tfrac{2}{3} b h_1^{\frac{3}{2}}$$

$$= 5 \cdot 25 \times \cdot 5 \times 2000 h_1^{\frac{3}{2}}$$

$$= 5350 h_1^{\frac{3}{2}}$$

$$\therefore h_1^{\frac{3}{2}} = \frac{D}{5350} = \frac{161500}{5350} = 30 \cdot 2$$

Hence, squaring both sides,

$$h_1^3 = \sqrt{30 \cdot 2}^2; \text{ and } h_1 = 30 \cdot 2^{\frac{2}{3}}$$

$$\log. 30 \cdot 2 = 1 \cdot 4800069 \times \tfrac{2}{3} = 0 \cdot 9866713,$$

and the natural number corresponding to this log. is 9·6978 feet, or 9·7 feet nearly.

2nd. What will be the depth when the discharge is reduced by the Chicago drainage channel to $161{,}500 - 12{,}500 = 149{,}000$ cubic feet per second?

As above, with same notation—

$$h_1^{\frac{3}{2}} = \frac{D}{5350} = \frac{149000}{5350} = 27 \cdot 85$$

Square both sides. Then

$$h_1^3 = 27 \cdot 85^2; \text{ and } h_1 = 27 \cdot 85^{\frac{2}{3}}$$

$$\log. 27 \cdot 85 = 1 \cdot 4448252 \times \tfrac{2}{3}$$

$$9 \cdot 2943 = 0 \cdot 9632168$$

the natural number to this log.

Height or head of water on the outlet or submerged dam at foot of Lake Huron when discharging 161,500 cubic feet per second	9·6978 feet.
Height or head of water on the outlet or submerged dam at foot of Lake Huron when discharging 149,000 cubic feet per second	9·2043 "
	0·4035 "
	12
Depression =	4·842 "

By the smooth curve of discharge of the Niagara River measurements, the discharge at mean level at Lake Erie, is 232,800 cubic feet per second. Assuming that 85 per cent is discharged by Lake Huron through the St. Clair river, is equal to 198,000 cubic feet per second.

Using the same formula and notation as above—

$$D = 8 \cdot 025 e \times \tfrac{2}{3} b h_1^{\frac{3}{2}}$$

$$= 5 \cdot 35 \times \cdot 5 \times 2000 h_1^{\frac{3}{2}} = 5350 h_1^{\frac{3}{2}}$$

$$h_1^{\frac{3}{2}} = \frac{D}{5350} = \frac{198{,}000}{5350} = 37$$

$$h_1^3 = 37^2; \text{ and } h_1 = 37^{\frac{2}{3}}$$

$$\log. 37 = 1 \cdot 5682017 \times \tfrac{2}{3}$$

$$11 \cdot 1 = 1 \cdot 0454678.$$

At this stage, the Chicago drainage channel, as shown at p. 38 will discharge 15,066 cubic feet per second, diminishing to that extent the discharge of Lake Huron.

This is $198{,}000 - 15{,}000 = 183{,}000$ cubic feet per second.

By the same process as above—

$$h_1^{\frac{3}{2}} = \frac{183{\cdot}000}{5{\cdot}350} = 34{\cdot}2$$

$$h_1{}^3 = 34{\cdot}2)^2; \text{ and } h_1 = 34{\cdot}2^{\frac{2}{3}}$$

$$\log 34{\cdot}2 = 1{\cdot}5340261 \times \tfrac{2}{3}$$
$$10{\cdot}563 = 1{\cdot}0226841$$

the corresponding natural number.

Height or head of water on outlet at foot of Lake Huron, discharging at mean stage, 198,000 cubic feet per second	11·1 feet.
Height or head of water on outlet at foot of Lake Huron, discharging 183,000 cubic feet per second, the efflux as reduced by the Chicago drainage channel	10·563 "
	0·537 "
	12
Depression of surface	6·444 "

When the Buffalo gauge registers + 1·8 feet, which is − 0·54 feet below the plane of reference of Lake Erie, the smooth curve of discharge of the Niagara River measurements indicates a discharge of 263,000 cubic feet per second. This elevation corresponds closely to an elevation of Lake Michigan of five feet above the monthly mean level of November, 1895.

Taking 85 per cent of this discharge as the outflow of Lake Huron in its normal condition, it becomes $263{,}000 \times {\cdot}85 = 223{,}550$ cubic feet per second.

The discharge by the Chicago drainage channel at this elevation as computed above (p. 33), is 17,540 cubic feet per second, diminishing in its abnormal condition the efflux of Lake Huron.

This gives $223{,}550 - 17{,}540 = 206{,}000$ cubic feet per second.

As above

$$D = 8{\cdot}025c \times \tfrac{2}{3}bh_1^{\frac{3}{2}} = 5{\cdot}35 \times {\cdot}5 \times 2000\, h_1^{\frac{3}{2}}$$

$$= 5350 h_1^{\frac{3}{2}}$$

$$\therefore \quad h_1^{\frac{3}{2}} = \frac{D}{5350} = \frac{223{,}550}{5350} = 41{\cdot}785$$

Squaring both sides—

$$h_1{}^3 = \overline{41{\cdot}785}\Big)^2 \text{ and } h_1 = 41{\cdot}785{\cdot}5^{\frac{2}{3}}$$

$$\log 41{\cdot}785 = 1{\cdot}6300204 \times \tfrac{2}{3}$$
$$12{\cdot}023 = 1{\cdot}0800136$$

the natural number corresponding to this log.

2nd. What will be the depth when the efflux is reduced to 206,000 cubic feet per second?

In the same manner as above—

$$h_1^{\frac{3}{2}} = \frac{D}{5350} = \frac{206{,}000}{5350} = 38{\cdot}5$$

$$\therefore \quad h_1{}^3 = 38{\cdot}5^2; \text{ and } h_1 = 38{\cdot}5^{\frac{2}{3}}$$

$$\log 38{\cdot}5 = 1{\cdot}5854607 \times \tfrac{2}{3}$$
$$11{\cdot}402 = 1{\cdot}0569738$$

the corresponding natural number.

Height or head of water on outlet at foot of Lake Huron, discharging, at high stage, 223,550 cubic feet per second	12·023 feet.
Height or head of water on outlet at foot of Lake Huron, discharging 206,000 cubic feet per second, the outflow as reduced by the Chicago drainage channel	11·402 "
	0·621
	12
Depression of lake surface	7·452 inches.

RECAPITULATION.

Depression of lake surface at lowest stage		4·892 inches.
" " mean "		6·444 "
" " highest "		7·452 "

It is not probable that these quantities respectively will vary one inch either way. It is scarcely necessary to add that, of all the lakes, the maximum effect will be felt in Lake Huron-Michigan.

THE TIME TAKEN TO DEPRESS THE SURFACE OF LAKE.

The combined area of Lakes Huron-Michigan is 46,250 square miles. This is equal to $46,250 \times 27,878,400 = 1,289,376,000,000$ square feet. With a depth of one inch this area will contain 107,448,000,000 cubic feet of water.

Assuming a mean average abstraction of 15,000 cubic feet per second from Lake Michigan by the Chicago drainage channel, it will take $107,448,000,000 \div 15,000 = 7,163,200$ seconds to lower the surface of Lake Huron-Michigan one inch.

$7,163,200 \div 3,600 = 2,000$ hours, nearly $= 83$ days.
For a depression of 3 inches gives $83 \times 3 = 249$ days.

Assuming that, in a lowering of 3 inches, the surface area will be contracted about 1 : 1000 part of its original size, we have approximately a water area of 46,200 square miles. 46,200 square miles $= 46,200 \times 278,784,000 = 1,287,982,080,000$ square feet. With a depth of one inch, this area will contain 107,311,840,000 cubic feet of water. At a mean discharge per the Chicago drainage channel of 15,000 cubic feet per second, it will take $107,331,840,000 \div 15,000 = 7,155,456$ seconds to depress the surface of the lake one inch. $7,155,456 \div 3,600 = 1,988$ hours $= 82\frac{1}{2}$ days. And to depress the lake surface $3\frac{1}{2}$ inches will take $82\frac{5}{8} \times 3\frac{1}{2} = 290$ days.

To depress the lake surface the first 3	inches	249 days.
" " " last $3\frac{1}{2}$	"	290 "
" " " $6\frac{1}{2}$	"	539 "

The foregoing calculations have not been verified.

EXTINCT OUTLET OF LAKE MICHIGAN.

The evidence in support of the theory that Lake Michigan, at some remote period of its history, discharged a part, at least, of its waters into the Gulf of Mexico by way of the Desplaines, Illinois and Mississippi rivers, is not only convincing and conclusive, but overwhelming.

THE HARVEST.

A report is the fruition, the crop, of an inquiry of this character. There is practically little else to show for the labour expended. Hence, if there be no report, there is no fruit, the result seems barren, the energy is wasted. When, as in this case, the report is only partial, the result may seem wholly incommensurate with the expenditure, a very small mouse indeed. But to judge fairly, it should be borne in mind that the report itself is only a small part,—the tangible part indeed,—a mere fraction of the labour involved in the preparation, in the accumulation and sifting of material in the initial or preliminary stages of the investigation. Very frequently the labour and outlay between a full report and no report at all, that is a report nipped in the bud, differs very little, although in the latter predicament there is practically nothing to show for the expenditure.

THANKS.

It affords me much pleasure to avail myself of this opportunity to acknowledge my obligations and return my best thanks to the following gentlemen for favours and courtesies conferred on me in connection with the service:

To all the gentlemen of the staff of the Marine and Fisheries Department with whom I have had official connection, for the very great kindness on all occasions, and for the cheerfulness and promptness they invariably evinced in affording me information and assistance.

To Hon. Edward Murphy, jr., United States Senator for the State of New York, for his great kindness in procuring for me through the public departments at Washington, several valuable reports, which have been to me of exceedingly great use in this investigation.

To Hon. J. B. Riley, United States Consul General, Ottawa, for many favours, not the least of which have been books, reports, and public documents procured from Washington, very rare and valuable, and difficult to obtain. Words fail to convey my appreciation of his kindness.

To General William P. Craighill, Chief of Engineers, United States Army, for all the information and other favours conferred on me, and the promptness with which he responded to my inquiries, both directly and indirectly.

To Major W. L. Marshall, Corps of Engineers, United States Army, in charge of the United States Engineer Office, Chicago, for drawings and blue prints of the United States survey of the proposed canal connecting Lake Michigan with the Mississippi river.

To Captain Thomas W. Symons, Corps of Engineers, in charge of the United States Engineer Office, Buffalo, N.Y., for a typewritten copy with tracing, of the unpublished report of Mr. J. C. Quintus of the discharge measurements of the Niagara river made in December, 1891.

To Mr. J. C. Quintus for his kindness in forwarding my letter to Captain Symons.

To Captain George A. Zinn, Corps of Engineers, United States Army, in charge of United States Engineer Office, Milwaukee, Wis., for his courtesy and kindness in replying to my letter, and inclosing a copy of the monthly means of the water levels of Lake Michigan, taken at Milwaukee, from the month of July, 1894, to November, 1895, both inclusive.

To Col. Jared A. Smith, Corps of Engineers, United States Army, in charge of United States Engineer Office, Cleveland, O., for his courtesy and kindness in promptly replying to my letter, and accompanying it with a copy of the monthly mean levels of Lake Erie, from the month of July, 1894, to November, 1895, recorded at Cleveland, Monroe, Mich., Ashtabula, O., and Erie, Pa.

To Major W. S. Stanton, Corps of Engineers, United States Army, in charge of the United States Engineer Office, Oswego, N.Y., for his courtesy and kindness in promptly replying to my communication, and inclosing therewith a copy of the monthly means of the water levels of Lake Ontario, from July, 1894, to November, 1895, both inclusive, taken at Oswego.

To Captain H. E. Waterman, Corps of Engineers, United States Army, Secretary of the Mississippi River Commission, St. Louis, for his courtesy in sending me several copies of the Annual Reports of the Mississippi River Commission, from its inception to 1894, with few exceptions.

To John A. Ockerson, Esq., United States Engineer, Mississippi River Commission, St. Louis, for his great kindness in having these volumes sent me through the secretary.

To Col. A. MacKenzie, Corps of Engineers, United States Army, Washington, D.C., for his prompt and courteous reply to my communication to the Chief of Engineers, a copy of which is found in Appendix B.

To Major E. H. Ruffner, Corps of Engineers, United States Army, Buffalo, N.Y., and now of Baltimore, Md., one of the Board of Engineers appointed by the United States Government to report on the effect of the Chicago drainage channel on the levels of the Great Lakes, for his prompt and courteous reply to my communication relative to the report of the board.

MISCARRIED.

I wrote Mr. Charles H. Keep, secretary of the Lake Carriers' Association, to Cleveland, O., for a copy of his estimate of the commercial losses by a reduction of the levels of the lakes, referred to in the report of the Board of Engineers. Not knowing his post office address, it is probable that my letter miscarried, as I have had no reply.

All of which is most respectfully submitted.

J. L. P. O'HANLY,
Civil Engineer.

Ottawa, February 29, 1896.

LIST OF DRAWINGS TO ACCOMPANY REPORT.

Plate No. 1.—Monthly mean of the water level curves of Lake Huron-Michigan, from June, 1859 to November, 1895, inclusive.

Plate No. 2.—Monthly mean of the water level curves of Lake Erie, from June, 1859, to November, 1895, inclusive.

Plate No. 3.—A tracing of Major Marshall's Map of that part of the United States Survey of the proposed waterway connecting Lake Michigan with the Mississippi river, between Lake Michigan and La Salle, Ill.

Plate No. 4.—Tracing of Lake Erie, with profile of the storm of October 14, 1893.

Plate No. 5.—Cross-section of the Desplaines Valley at Lemont, showing the proposed Chicago Drainage Channel, the Illinois and Michigan Canal, the Desplaines and diverted Desplaines river, &c.

Plate No. 6.—Map showing the Great Lakes and their drainage area or basin, with the Desplaines and Illinois rivers, and the Mississippi.

Plate No. 7.—The velocity, discharge and gauge relation curves of the United States discharge measurements of the Niagara river in December, 1891, and in April and May, 1892.

Plate No. 8.—The discharge cross-sections of the Niagara river at Black Rock, and Lower Black Rock, at the foot of Lake Erie.

Plate No. 9.—Cross-sections, in earth and rock, of the Chicago Drainage Channel.

(*Copy.*)

APPENDIX A.

Report of the Board of Engineers, appointed by the United States, on the probable effect of the Chicago Drainage Channel on the levels of the Great Lakes addressed to General William P. Craighill, Chief of Engineers, United States Army.

(From the New York *Engineering News* October 3, 1895.)

The board met in Chicago, August 12, 1895, and on August 13 and 14 accompanied the officers of the drainage canal over the line under construction. Every facility and courtesy possible has been extended by the trustees and engineers of the canal for a full investigation of the subject matter. A brief

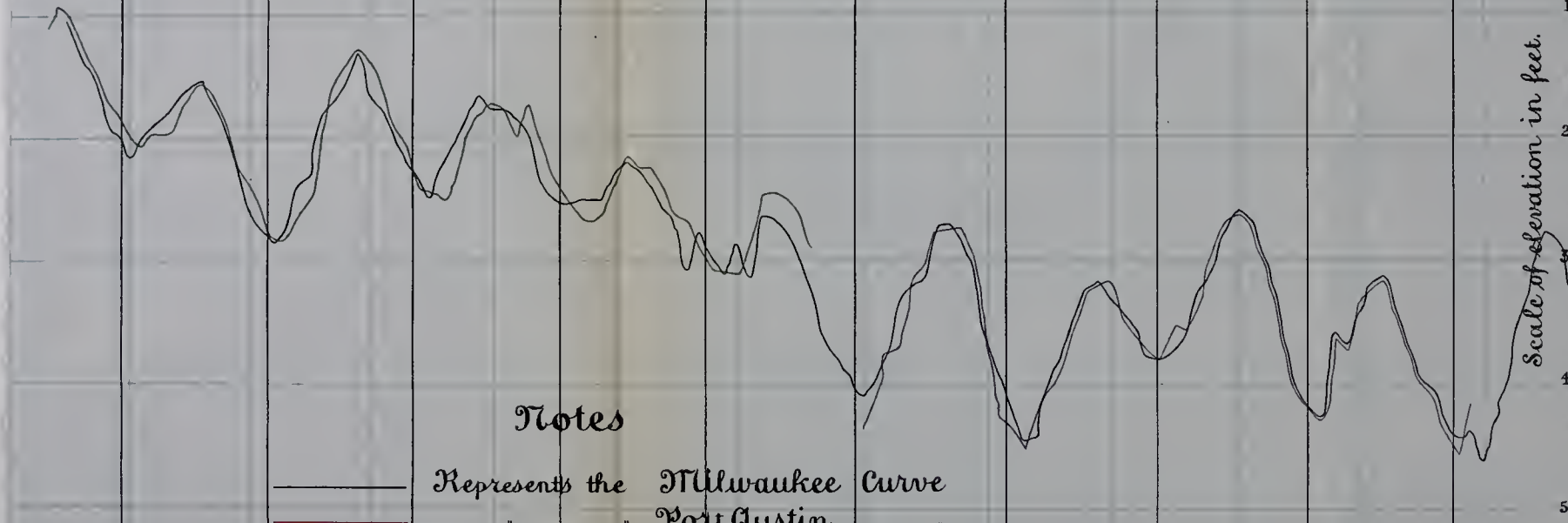
SHEET, NO. 1.

Ann

1859 | 1860 | 1861 | 1862 | 1863 | 1864 | 1865 | 1866 | 1867 | 1868 | 1869 | 1870 | 1871 | 1872

Plane of Reference.

Scale of elevation in feet.



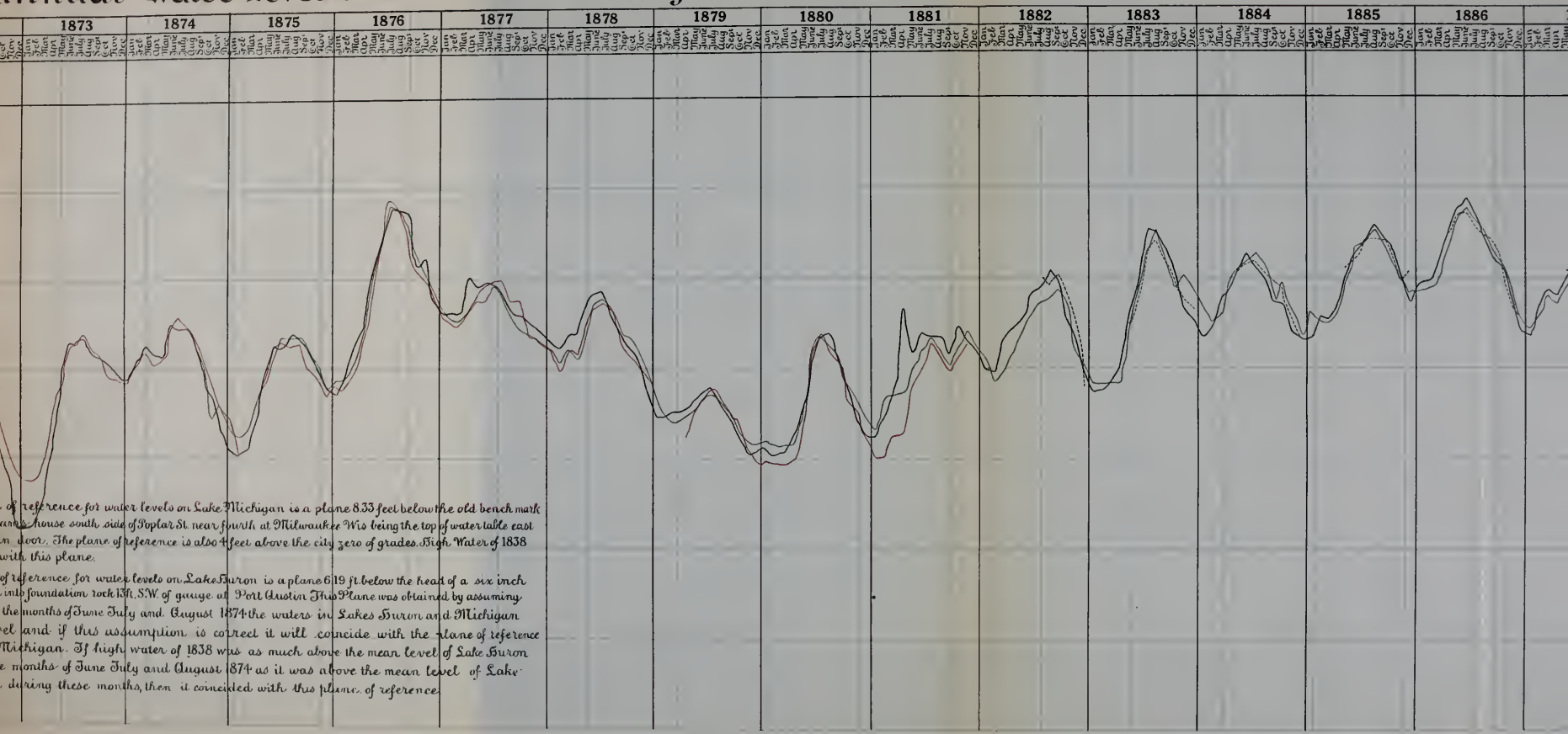
Notes

Represents the Milwaukee Curve
" " Port Austin "
" " Chicago "
" " Pt. Aux Barques "
" " Escanaba. "

The plane of refere
on Dr Lapham's house
side of main door. T
coincided with this p

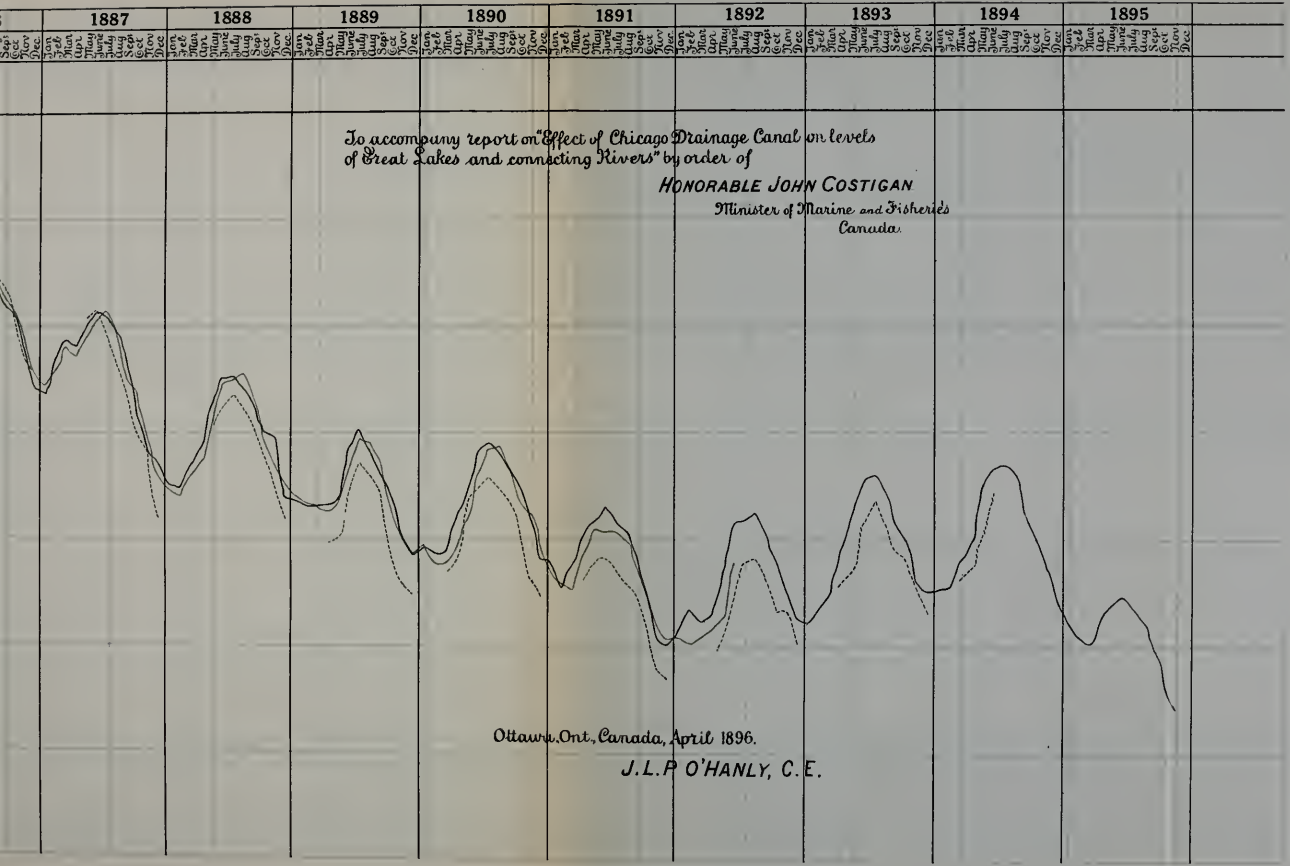
The plane of reference
bolt leaded into founda
that during the months
were level and i
for Lake Michigan
during the months
Michigan during t

Annual Water Level Curves Lakes Michigan and Huron.



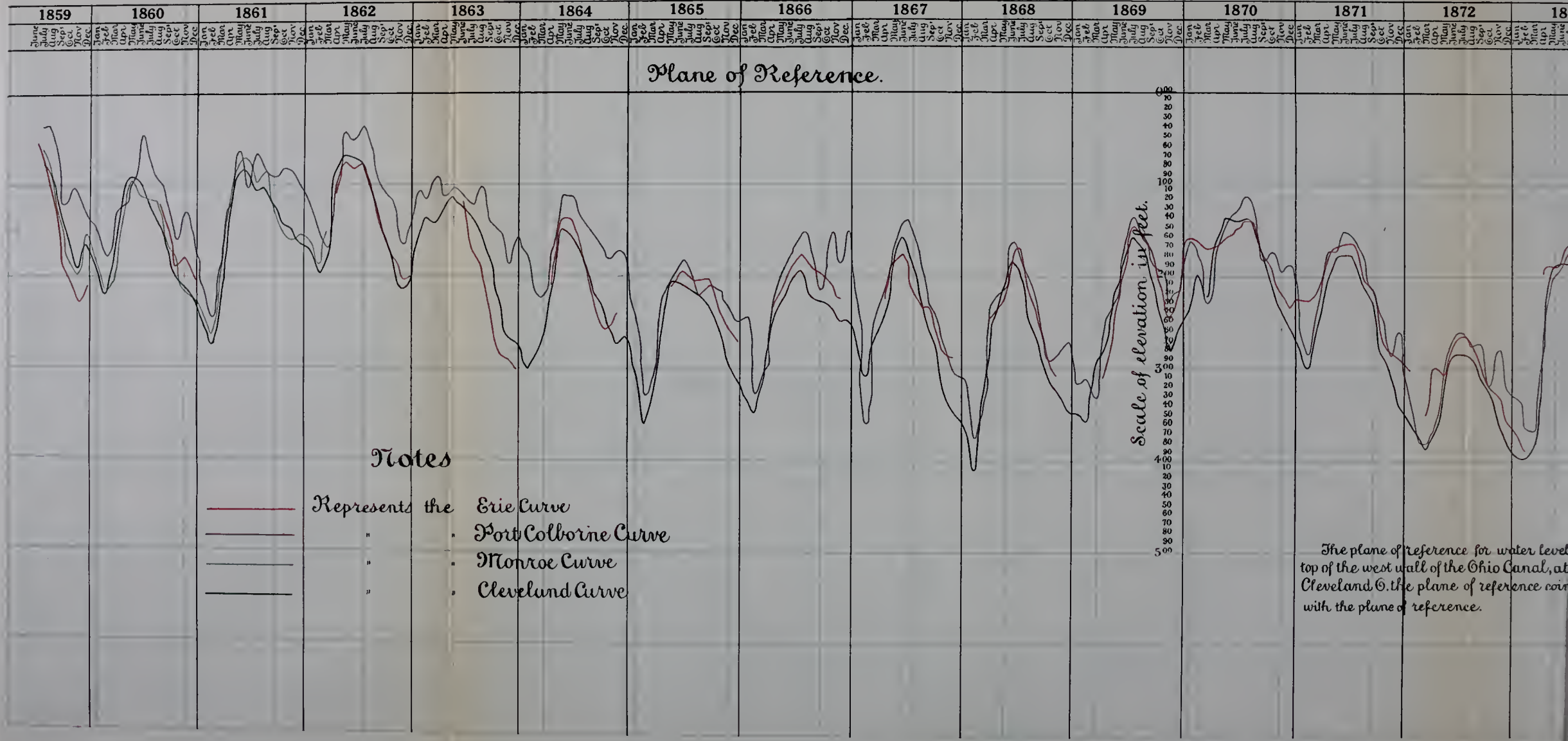
of reference for water levels on Lake Michigan is a plane 8.33 feet below the old bench mark
arner house south side of Poplar St. near fourth at Milwaukee Wis being the top of water table east
n door. The plane of reference is also 4 feet above the city zero of grades. High Water of 1838
with this plane.

of reference for water levels on Lake Huron is a plane 6.19 ft below the head of a six inch
into foundation rock 13 ft. S.W. of gauge at Port Huron This Plane was obtained by assuming
the months of June July and August 1874 the waters in Lakes Huron and Michigan
el and if this assumption is correct it will coincide with the plane of reference
Michigan. If high water of 1838 was as much above the mean level of Lake Huron
e months of June July and August 1874 as it was above the mean level of Lake
during these months, then it coincided with this plane of reference.

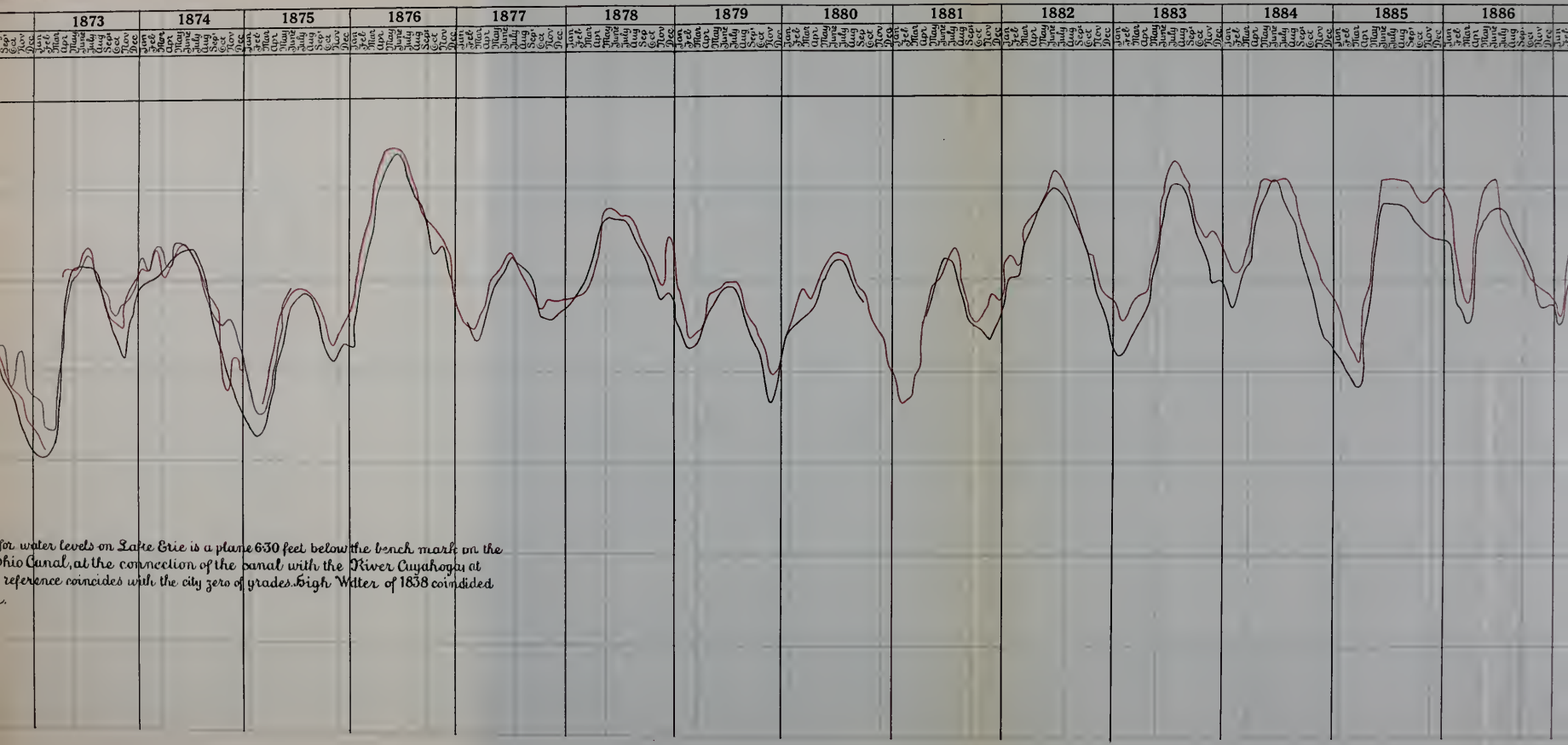

1887
1888
1889
1890
1891
1892
1893
1894
1895
To accompany report on "Effect of Chicago Drainage Canal on levels of Great Lakes and connecting Rivers" by order of
HONORABLE JOHN COSTIGAN
Minister of Marine and Fisheries
Canada.
Ottawa, Ont., Canada, April 1896.
J.L.P O'HANLY, C.E.

SHEET, NO. 2.

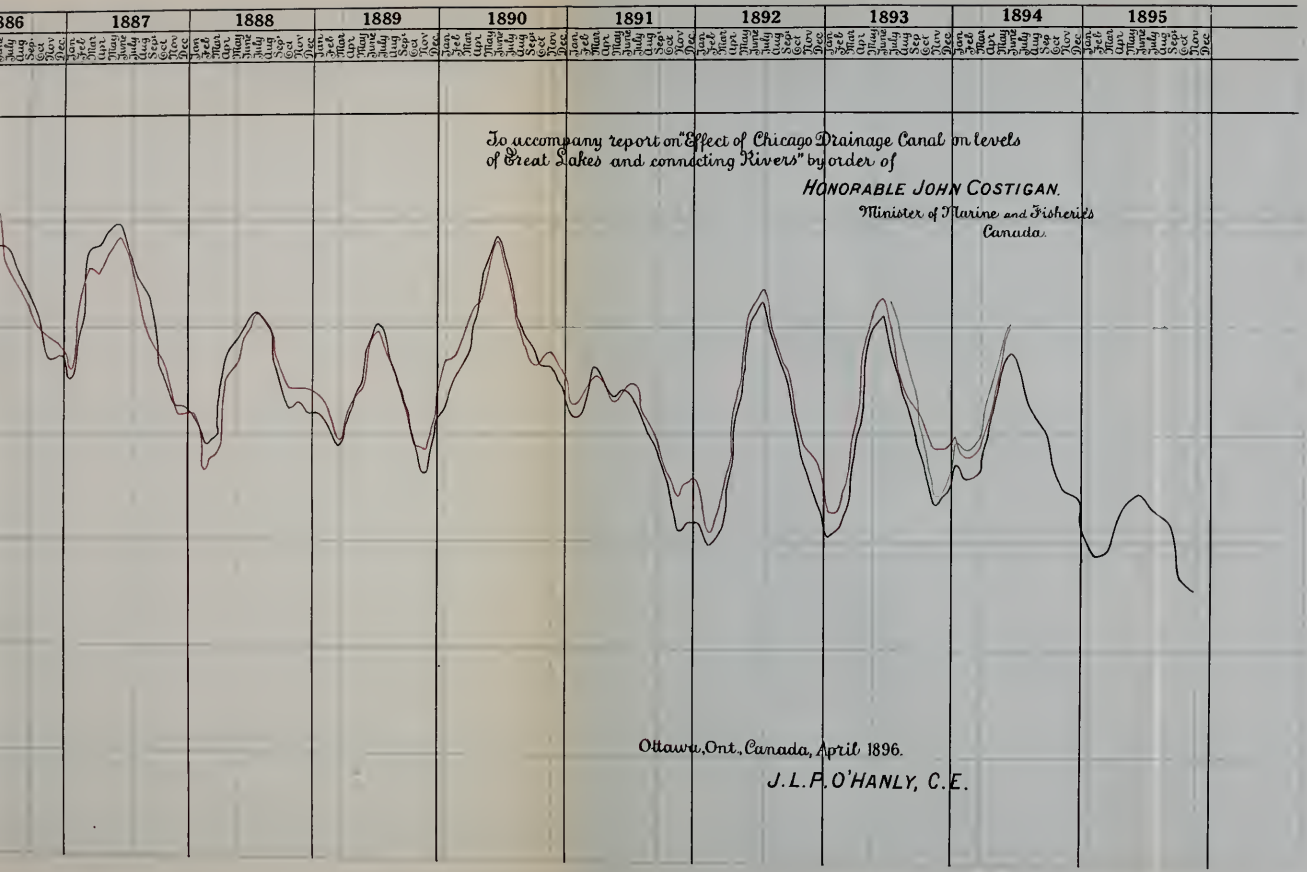
Annu



Annual Water Level Curves Lake Erie.



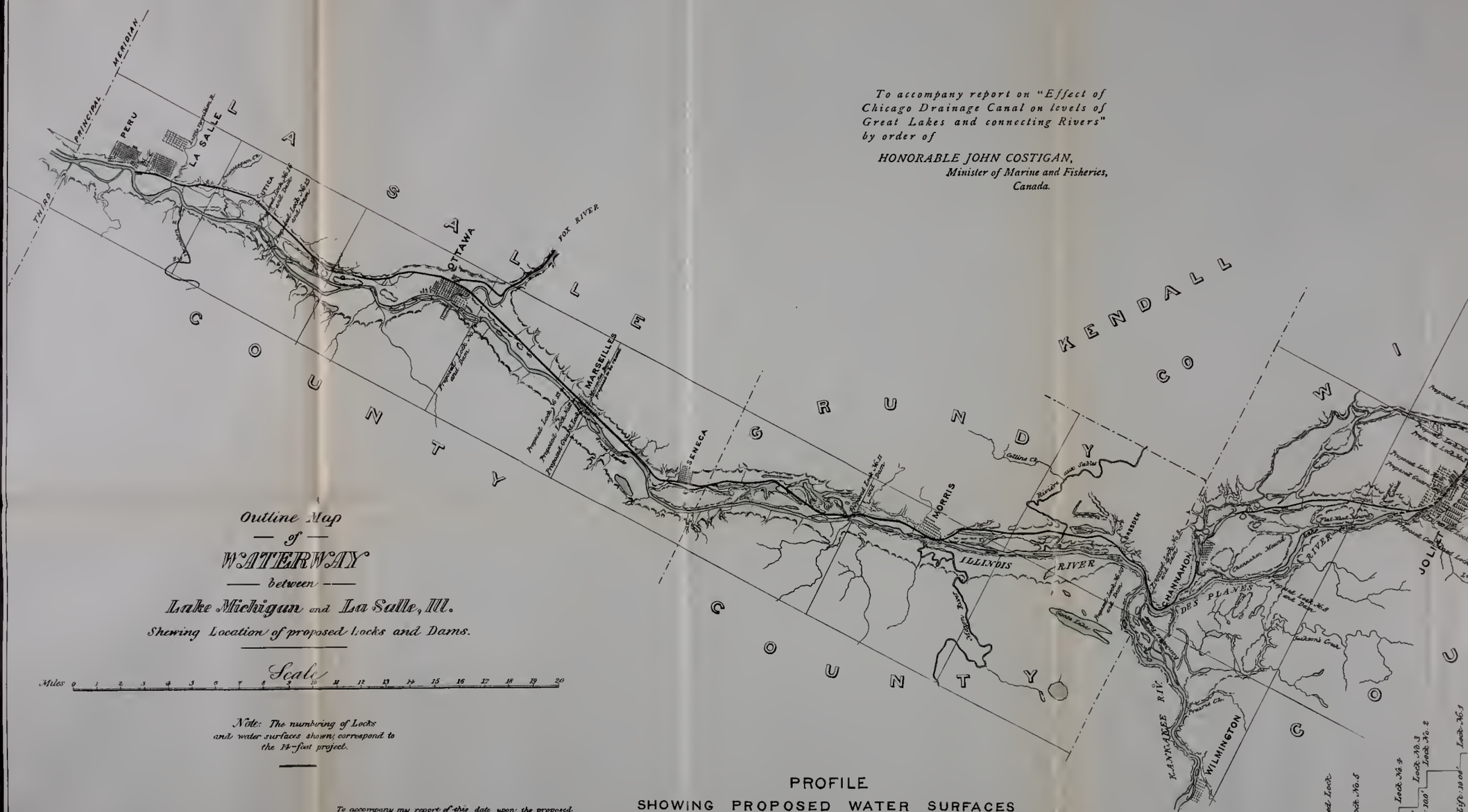
for water levels on Lake Erie is a plane 6.30 feet below the bench mark on the
Ohio Canal, at the connection of the canal with the River Cuyahoga at
reference coincides with the city zero of grades. High Water of 1838 coincided
.


1886
1887
1888
1889
1890
1891
1892
1893
1894
1895
To accompany report on "Effect of Chicago Drainage Canal on levels of Great Lakes and connecting Rivers" by order of
HONORABLE JOHN COSTIGAN.
Minister of Marine and Fisheries
Canada.
Ottawa, Ont., Canada, April 1896.
J.L.P. O'HANLY, C.E.

SHEET NO. 3.

To accompany report on "Effect of Chicago Drainage Canal on levels of Great Lakes and connecting Rivers" by order of

HONORABLE JOHN COSTIGAN,
Minister of Marine and Fisheries, Canada.



Outline Map
— of —
WATERWAY
— between —
Lake Michigan and La Salle, Ill.
Shewing Location of proposed Locks and Dams.

Scale

Miles 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Note: The numbering of Locks and water surfaces shown, correspond to the 14-foot project.

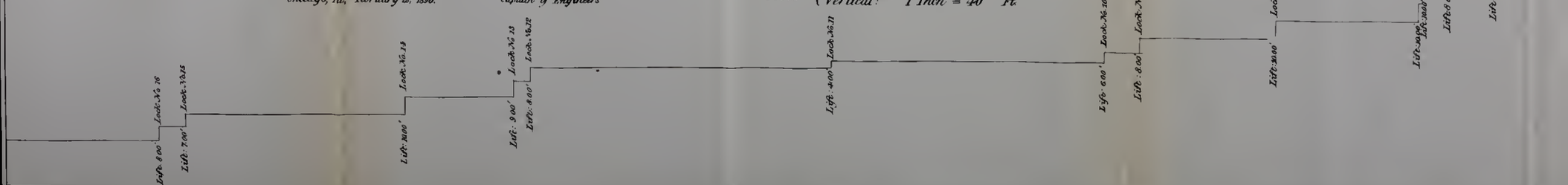
To accompany my report of this date upon the proposed Waterway between Lake Michigan and Mississippi River.

Chicago, Ill, February 28, 1890.

W. L. Marshall
Captain of Engineers

PROFILE
SHOWING PROPOSED WATER SURFACES
AT LOW WATER

Scale { *Horizontal: 1 Inch = 10000 Ft.*
Vertical: 1 Inch = 40 Ft.



mpany report on "Effect of
Drainage Canal on levels of
kes and connecting Rivers"
f

ABLE JOHN COSTIGAN,
Minister of Marine and Fisheries,
Canada.

GENERAL CONTOUR CHART OF LAKE ERIE,

TOGETHER WITH PROFILE OF WATER SURFACE ALONG ITS SOUTH SHORE DURING WESTERLY GALE OF OCTOBER 14. 1893.

U.S. Engineer Office
Cleveland, Ohio, June 30, 1896
To accompany Report on water levels of Lake Erie.

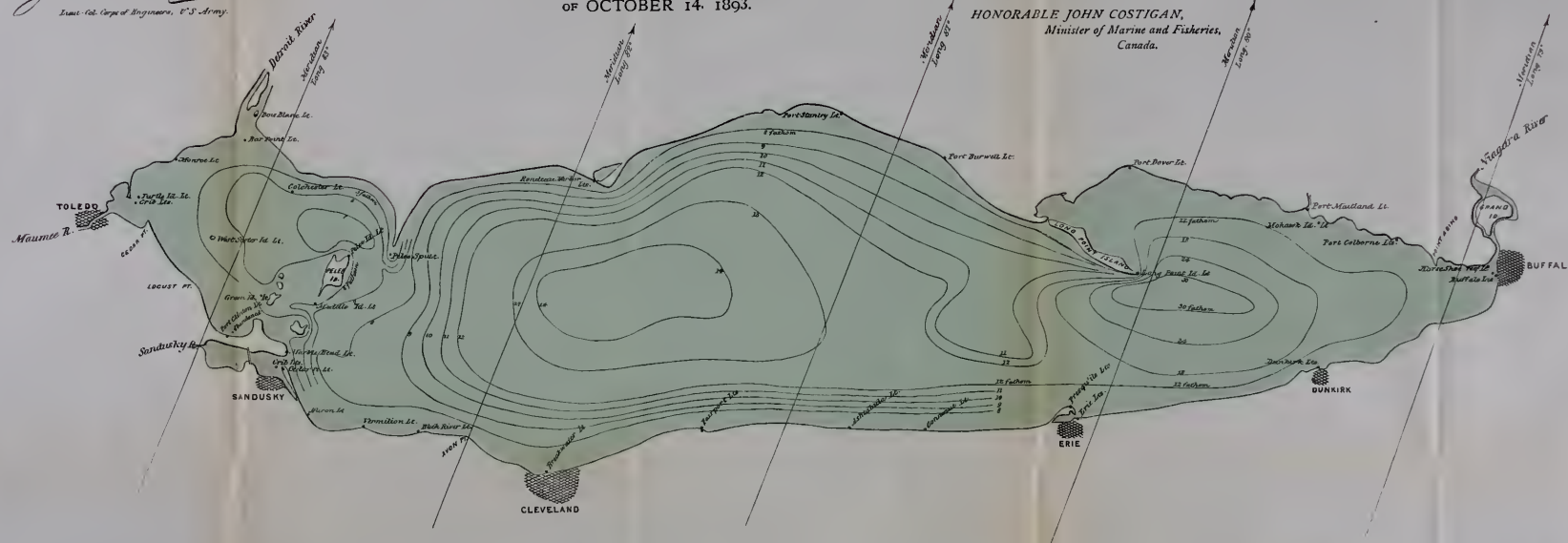
Jared A. Smith
Lieut.-Col. Corps of Engineers, U.S. Army.

To accompany report on "Effect of Chicago Drainage Canal on levels of Great Lakes and connecting Rivers" by order of

HONORABLE JOHN COSTIGAN,
Minister of Marine and Fisheries,
Canada.

To accompany Report of this date to
Lieut.-Col. Jared A. Smith, Corps of Engrs U.S.A.

Wm. H. Bixby
June 20th. 1894 — Asst Engr



Copied from Report of Chief of Engineers, U.S.A. for 1894.

Ottawa, Ont., Canada, April, 1896.

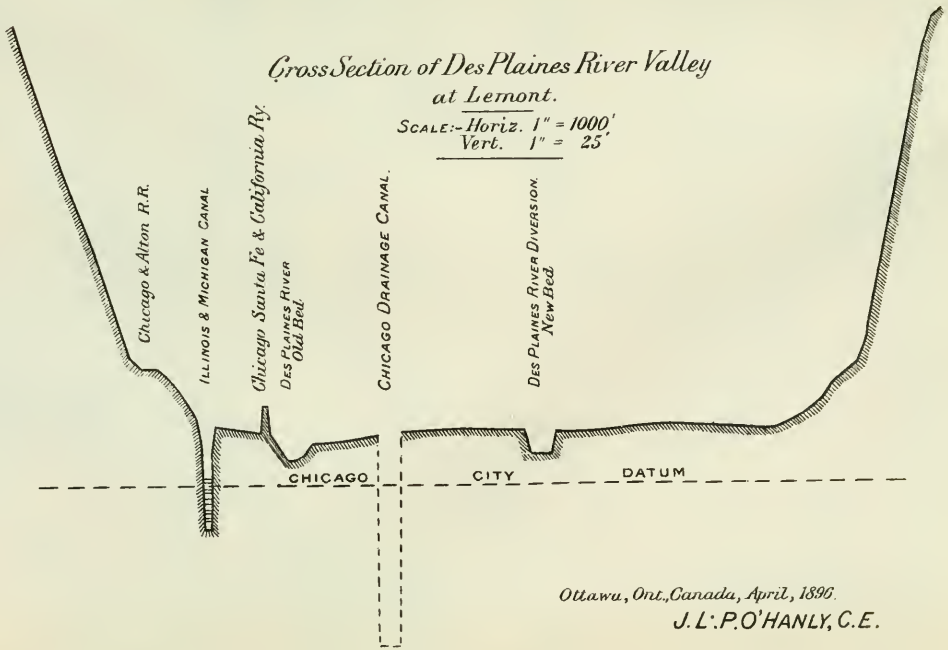
J. L. P. O'HANLY, C. E.

Scale of Miles. 1:600,000

To accompany report on "Effect of Chicago Drainage Canal on levels of Great Lakes and connecting Rivers" by order of

HONORABLE JOHN COSTIGAN,
Minister of Marine and Fisheries, Canada

PLATE V.



Ottawa, Ont., Canada, April, 1896.

J. L. P. O'HANLY, C.E.

LONGITUDINAL SECTION
OF THE GREAT LAKES AND CONNECTING RIVERS.

To accompany report on "Effect of Chicago Drainage Canal on levels of Great Lakes and connecting Rivers" by order of

HONORABLE JOHN COSTIGAN.
Minister of Marine and Fisheries
Canada.

Map Showing
The Drainage Basin of the
GREAT LAKES
—with the—
Des Plaines, Illinois and Mississippi Rivers.

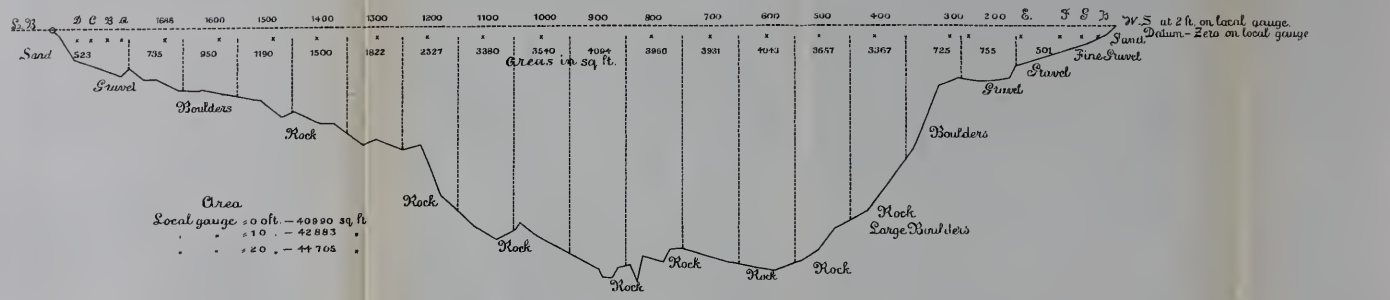
Ottawa, Ont, Canada, April 1896.
J. L. P. O'HANLY, C. E.

To accompany report on "Effect of Chicago Drainage Canal on levels of Great Lakes and connecting Rivers" by order of

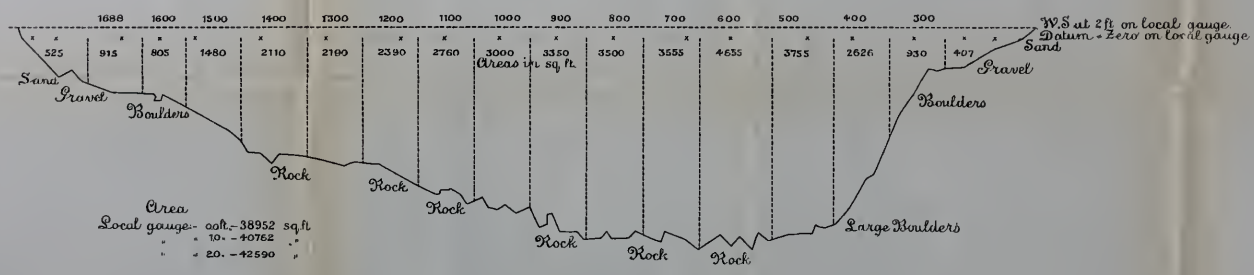
HONORABLE JOHN COSTIGAN
Minister of Marine and Fisheries
Canada.

Discharge Sections

Black Rock Section.



Lower Black Rock Section



Horiz. Scale ¼" = 100 ft
Vertic. ¼" = 10 ft

Discharge Observations
Niagara River
N.Y.

April – May 1892

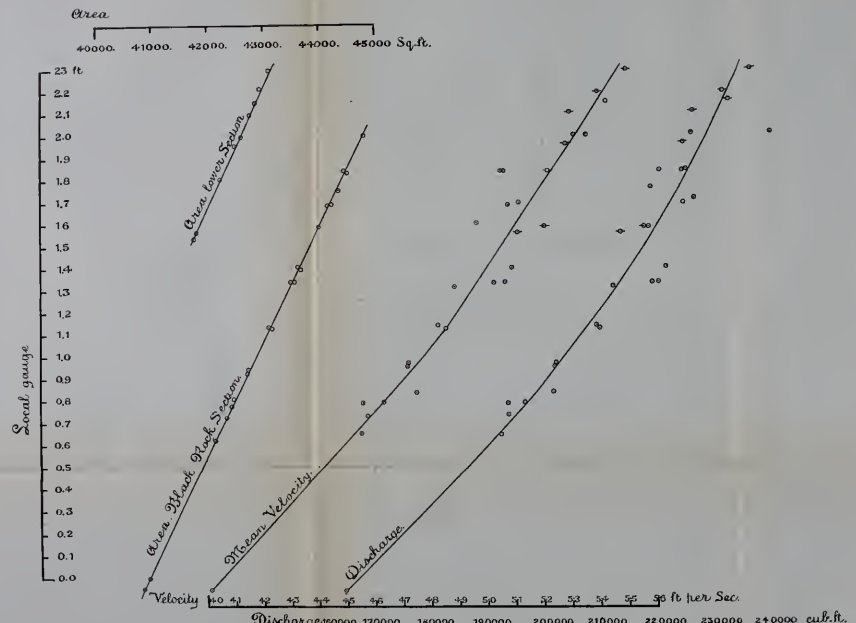
Made under the Correction of Major
C.J.S. Ruffner, Corps of Engrs U.S.A., by
J. C. Quintus.

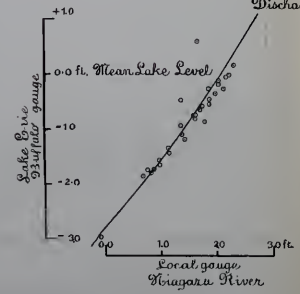
Copied from Report of Chief of
Engineers, U.S.A. for 1893.

Ottawa, Ont. Canada, April 1896.
J.L.P. O'HANLY, C.E.

To accompany report on Effect of Chicago Drainage Canal on levels of Great Lakes and connecting Rivers by order of

HONORABLE JOHN COSTIGAN.
Minister of Marine and Fisheries
Canada.





Equation of smooth curve of Discharge.

Discharge = 160000 + 4.3702 x − 6.182 x² ---- etc.

x = Local gauge height.

o - on lower section.

Results of series of obs. taken Dec. 1891. are included in plate.

Equation of smooth curve of gauge relation

Local gauge height = 2.087 + 6.2X − 0.46 x² ---- etc.

x = Buffalo gauge height.

o - Mean gauge heights Buffalo and Local gauges during time of discharge measurements.

Ottawa, Ont. Canada. April 1896

J. L. P. O'HANLY, C.E.

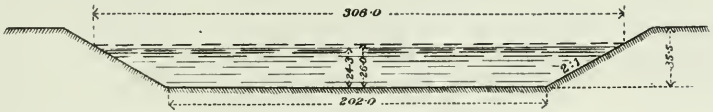
Copied from Report of Chief of Engineers U.S.A. for 1893

To accompany report on "Effect of Chicago Drainage Canal on levels of Great Lakes and connecting Rivers" by order of

HONORABLE JOHN COSTIGAN,
Minister of Marine and Fisheries, Canada.

PLATE IX.

SANITARY CANAL – CHICAGO.



CROSS SECTION IN EARTH.

CROSS SECTION IN ROCK.

Ottawa, Ont., Canada, April, 1896.

J. L. P. O'HANLY, C.E.

description of the canal is extracted from the printed report furnished the board by these gentlemen:

The main drainage channel of the sanitary district of Chicago is now under contract from its confluence with the south branch of the Chicago river, at Robey Street, in the city of Chicago, to its southern terminus, in Will County, Ill. At the southern end of the channel the controlling works will be located. Beyond these works, the construction contemplated by the district will be the work nesessary for conducting the flow from the channel in conjunction with the waters of the Desplaines river, down the declivity to and through the city Joliet, and making such change in the Illinois and Michigan canal as the new conditions developed will make necessary.

The first work put under contract extended southwesterly from the Willows Sprigs Road, and these sections were numbered consecutively, Nos. 1 to 14.

Average length of sections, one mile. Easterly from Willow Springs road, the section are lettered from A to O, omitting J. The lettered sections are, except for a short distance near Summit, entirely in glacial drift, defined in the specifications thus: 'Glacial drift shall comprise the top soil, earth, muck, sand, gravel, clay, hardpan, boulders, fragmentary rock displaced from its original bed, and any other material that overlies the bedrock.'

The sections from 1 to 14 were put under contract in July, 1892; from A to F were put under contract late in 1892 and early in 1893, and G to M inclusive were contracted for in December, 1893. Sections N and O were put under contract May 2, and Section 15, August 27, 1892. Earth was first broken on 'Shovel Day,' September 3, 1892, on the rock cut below Lemont.

The Desplaines valley is traversed by the river from which it takes its name, a stream of wide fluctuations, with no constant and reliable fountain supply. During some seasons its whole discharge would pass through a 6-in. pipe, and at others its volume reaches 800,000 cubic feet per minute. Then it rolls majestically along, flooding the whole valley. Such being the situation, control of this stream was a condition precedent to the successful prosecution of the work upon the main channel. This control has been secured by the outlay of nearly $1,000,000 in constructing what is known as the River Diversion channel.

About 13 miles of new river channel had to be excavated with the location of the Main Drainage channel, and about 19 miles of levee build to divorce the waters of the Desplaines watershed from the channel which is to receive the waters of Lake Michigan, and pass them on to the Mississippi river, via the Lower Desplaines and Illinois rivers. The width of the river diversion channel on the bottom is 200 feet, side slopes 1½ to 1, grade generally 0·12 feet per 1,000 feet.

At the head of this river diversion it was necessary to provide a safety valve in the form of a spillway, to allow surplus water to flow towards Chicago, because arrangements have not as yet been perfected for carrying the entire flood waters of the Desplaines through Joliet.

This spillway is a concrete dam capped with cut stone and its wings faced with stone masonry. It is 397 feet long and its crest is 16·25 feet above Chicago datum (this datum is referred to the low water of Lake Michigan of 1847, and is 579·61 feet above sea level at Sandy Hook). No water flows over this spillway until the volume passing the water-gauge above it reaches 300,000 cubic feet per minute.

The cross-section of the earth sections from A to E inclusive is 202 feet on the bottom, with side slopes of 2 to 1. This section extends for about 500 feet into the westend of F, and then reduces to 110 feet on the bottom, preserving the same side slopes. The explanation for this change of cross-section is as follows:—Throughout the rock sections and those in which there is a prepon-

derance of hard material, or where rock may appear, the section adopted is designed, according to law, for a flow of 600,000 cubic feet of water per minute, which means provision for a population of 3,000,000 people. The narrow channel provides for a flow of 300,000 cubic feet per minute, or for about the present population of Chicago. The enlargement of the narrow channel can be made by the easier methods of excavation, such as dredging, whenever the needs of the city require it. The grade throughout the lettered sections is 1 foot in 40,000 (·025 feet per 1,000 feet) and the bottom of the channel at Robey Street is 24·448 feet below datum. The numbered sections, from No. 1 to No. 6 inclusive, are underlaid with solid rock. The width of the bottom, in rock, is 160 feet, and walls of masonry laid in cement will be built upon the rock surface to a height of 5 feet above datum. Sections 7 to 14, inclusive, are in solid rock, width at bottom, 160 feet; sides vertical, prism taken out in three slopes with offsets of 6 inches on each side for each cut, making top width of 162 feet; grade in rock, 1 foot in 20,000 (·05 feet per 1,000.)

Section No. 15 is also in rock, and its cross-section is enlarged at its south end so as to form a 'windage basin,' in which large vessels may be turned around. The controlling works are located on this section. These works will consist of gates or movable dams, by which the flow of water from the main channel into the tail race, which is to deliver the outflow into the Desplaines river can be controlled.

This river below Lockport follows the trough of the valley down a steep declivity to the canal basin in Joliet. The fluctuations in Lake Michigan by varying slope of water surface, will be felt at the controlling works, and provision must be made to meet these fluctuations within a range of 5 feet above datum, and 8 feet below, or an extreme oscillation of 13 feet. The fall from datum at the controlling works to the level of the upper basin will be about 42 feet in a distance of about 4¼ miles. As the plans for controlling works have not been finally adopted by the Board of Trustees, they cannot now be discussed.

The total amount of excavation involved in the construction of the main channel is 26,077,765 cubic yards of glacial drift, and 12,071,668 cubic yards of solid rock, or an aggregate of 38,149,433 cubic yards to which must be added the material excavated from the river diversion: glacial drift, 1,564,403 cubic yards; solid rock, 258,926 cubic yards; total river diversion, 1,823,329 cubic yards; grand total, main channel and river diversions, 39,972,762 cubic yards. All of this work is now under contract, and in addition thereto 384,958 cubic yards of retaining wall.

In response to the request of the senior member of the Board, the Board of Trustees of the Sanitary District of Chicago has furnished a report on lake level effects on account of the main channel of the Sanitary District of Chicago, containing briefs by Trustee L. E. Cooley, C.E., and by Thos. T. Johnston, Assistant Chief Engineer, accompanied by numerous blue prints. These papers present a full discussion of the subject as viewed by the canal officials.

What is the outflow of the Lower Lakes?

In November, 1891, the Chief of Engineers, U.S.A., at the request of the secretary of the American Society of Civil Engineers (who had been asked by the chief engineer of the Montreal Harbour Commission of Canada to suggest the subject), ordered a set of observations made to determine the amount of water flowing down the Niagara river. The time was especially propitious, as the water was then very low.

The results of these measurements were somewhat unexpected, and they were repeated in May, 1892. The second set corroborated the first, and the whole formed the subject of a report to the Chief of Engineers, which appeared in his annual report of 1893 pages 4, 364 and following. But as the subject was important, the *Engineering News* anticipated the appearance of the official report by publishing in its issue of March 2, 1893, this report with the permission

of the chief of engineers. This publication was the first ever made in which, as a result of careful measurements, a relation between the level of the lakes and their outflow, or discharge, had been established and given to the public. Prior determination of this discharge had not attempted to detect this relation, and nothing more than a general determination of a season's work had been published. In all plans for the Chicago Drainage Canal, the early measurements had been taken, and those studying the subject chose such isolated figures as suited them best.

The report of 1892, being so late in appearance, long after the drainage canal was put under construction, escaped the notice of many who are interested in navigation for two reasons. Some were too busy to see anything unless specially brought to their notice. Others thought the whole matter already fully canvassed and settled. It is true there is nothing showing that the consent of Congress had been asked for this enterprise; certain that the subject had not been treated as an interstate affair, to say nothing of its being an international affair. The United States has always been slow to move; with its many sleeping rights, it has for many years been loth to exercise them. Not till 1888 did it begin to exercise positive legislation over its navigable waters in order to preserve them for all its citizens. Each river and harbour Bill since then is found to have sections strengthening the hands of those who wish to keep the waterways open and in good order, for all classes of navigators. Not till 1890 had any prohibitive clauses been enacted into laws forbidding, for example, the destruction of channels by improper dumpings. Saw-mills went their own unchecked way every year, clogging up streams. Railways bridged all smaller streams, in the States, without interference from the United States. Many other features can be quoted. But it is sufficient to say that all that is now changed. The adopted policy is to defend, as well as improve, all water courses, now navigable, or probably navigable, in the reasonably close future. Waterways are under the charge of the United States, and there is no likelihood of their being abandoned for some time to come.

With this an established fact it is impossible to think that United States supervision shall not be extended to the Chicago drainage canal in due time. Under whatever law built, and for whatever purpose constructed, just so soon as it is shown that that canal affects, or becomes a part of the system of navigable waterways of the United States, some supervision or control of it must follow. When boats use it for harbour purposes; when its waters add to the Illinois river, or take from the lakes, they alter natural conditions and the matter rises for consideration under national authority.

The water levels of the Great Lakes are very delicate. Storms, barometric changes, rainfall, even tidal changes, are felt. Records show at Buffalo no less than 13 feet as a total possible change between the lowest and the highest gauge readings. Each lake is a basin. The water is constantly pouring in from not only one, but several inlets. The overflow, however, is now always out of the one inlet provided for that purpose; the second one, formerly at Chicago, has been plugged up.

As in our basins, when the water rises enough to take two, three or more of the small holes to carry it off, it is always to be noted that those holes are always carrying that surplus off; they do not wait until the water has time to pass from one end to the other. In the same channel the head alone governs the rate of overflow, and that head is measured by the gauge-reading at the outlet. The supply of water in the lake, the net supply, allowing for evaporation, is the sole cause of the outflow. That supply depends solely upon rainfall; but the lake, when it receives more than it has been receiving, must discharge more; when it has less, there is less to run out. If the outlet be dug down, or new ones made, the water runs off faster than it ran off before.

The outflow is instantly affected by a changed inflow, provided there is enough such to increase or reduce the head. If we have a rainfall of 1 inch over the lake area (and such are not uncommon events,) there is a head of 1 inch to run off. But if there are two outlets to run out of, instead on one, this inch must run off sooner than through the one. If the new outlet should reduce the levels of Lakes Michigan and Huron about 6 inches, this effect will be produced in full in about two years; it is not then a question of many years, as some suppose.

We may feel very sure, therefore, that in this question two points are certain: 1. The drainage canal is not solely a state affair, but a national one. 2. The tapping the lakes must affect their levels. But it is said, first, that the changes in levels do not concern shippers, and then that, at most, the effects will be trifling.

If one watched carefully the course pursued by shippers one would see that as a rule, each vessel carries all that it can take and get out of its port or into that it intends to reach. Vessel owners and managers are very shrewd, watchful men; they know what they can safely carry, allowing for storms and short detentions arising from passing causes; they average pretty well the practicable depths, and carry all the channels will stand. They are as conversant as are theorists about the effects of storms, but they keep good watch on ruling depths. Now, should it be certain that these average depths were reduced 3 inches, or 6 inches, they must load accordingly. And not only the large boats, but also the small ones using the small harbours that the large ones cannot go into. All must lose the 3 or 6 inches, as it may be; and not for one or more trips, but for all trips, and for all time; a diminution of capacity is not a single tax, but a continuous one. A vessel that when light draws 6 feet and loaded 12 feet must lose 3 inches out of 72, say 4 per cent in capacity, each loading; a vessel drawing 12 feet light and 20 feet loaded would lose somewhat over 3 per cent in capacity at each and every loading.

Should the loss of levels be 6 inches, instead of 3 inches, then these figures become doubled. Will the loss be six inches or will it be three inches? This is an important question, and we have only the Niagara river discharge observations from which to answer it. These cover a range of about 1·8 feet. There were scattering observations outside these limits, but the mass of results was secured between gauge readings, mean lake level, the highest, and 1·85 feet. The 'smooth curve' as published enables us to note the fall of 0·53 feet on the gauge per 10,000 cubic feet per second for the first foot of fall, and 0·44 feet for the whole.

These observations, especially at the lower readings are erratic, and indicate a need for more measurements, especially at these levels. This lower portion of the gauge should be studied and additional observations made and the board is a unit in suggesting the importance of the series of gaugings of the St. Clair river at the present time for this purpose, and to furnish additional knowledge of the relation between gauge readings and dischagre. The subject is of such general bearing upon the navigation of the lakes that it demands careful treatment and full data. The Niagara data do not show how much Lakes Huron and Michigan would be lowered, even if 0·53 feet were the net loss to Erie. The opinion expressed by Mr. Johnston that the effect on the two upper lakes would be some 15 per cent greater than upon Erie would seem to point to a probable loss of, say 0·61 feet. This possible loss of 7 inches certainly is important enough to justify careful measurements of the discharge through the St. Clair. It is true that the law as it stands, and the intention of the trustees, contemplate the abstraction of only 300,000 cubic feet under present conditions; but after the canal is opened measurements will not be so instructive, and we must assume that ultimatley the en ire 600,000 cubic feet per minute will be drawn from Lake Michigan, as required by the state law.

The abstraction of 10,000 cubic feet of water per second from Lake Michigan will lower the levels of all the lakes of the system except Lake Surperior, and reduce the navigable capacities of all harbours and shallows throughout the system to an extent that may be determined, if at all by actual measurements only. Under the laws of the United States these changes in capacity cannot be made without federal authority, and to enable the executive officers of the United States to act advisedly in the matter it is necessary, in the opinion of the board, not only that these measurements be taken, but that the money cost of restoring the navigable depths in channels and harbours be carefully estimated.

In this connection the board submits, without expression of opinion, an estimate prepared by Mr. Charles H. Keep, Secretary of the Lake Carriers' Association, of the commercial losses in carrying capacity of the lake fleet should a reduction be made in lake levels of 1, 3 or 6 inches.

The board notices that the same peculiarity exhibited by the Niagara discharge curve is pointed out by Mr. Johnston as existing in the Morris, Ill., and South Branch Chicago River curves.

The board also notes Mr. Johnston's conclusions that:

Applying the reasoning to the St. Clair and Detroit rivers, the value of the $Q1$—Q may be taken from the diagrams illustrating the tables before described, the only uncertainty being as to the value of a. Suppose a to be a unity, and the mean depth 20 feet. Then $Q1$—Q will equal something greater than 20,000 cubic feet per second.

This practically corresponds with the deductions made from the Niagara River observations.

So many uncertainties arise in the application of hydraulic formulas that the only way to ascertain the approximate discharge of these streams is to measure them for periods long enough to eliminate accidental fluctuations and to cover all stages.

While the navigable capacity of all harbours and channels on the Great Lakes below St. Marys falls will be injuriously affected by a diminution in depth, the navigability of the inner harbour of Chicago will be diminished also by the introduction of a current therein, which, in the present condition of the river, even with the minimum flow of 5,000 cubic feet per second, or 300,000 cubic feet per minute, is entirely inadmissible. The estimates of the effect of the drainage canal upon this harbour should also consider this element.

The Board of Trustees have not yet determined upon a plan of treatment of this navigable channel, and their plans may be such as may improve, impair or destroy its utility as a navigable river.

All of which is respectfully submitted.

O. M. POE,
Col. Corps of Engineers, Bvt. Brig.-Gen., U.S.A.

E. H. RUFFNER,
Major of Engineers, U.S.

W. L. MARSHALL,
Major, Corps of engineers.

APPENDIX B.

(Copy.)

OFFICE OF THE CHIEF OF ENGINEERS, UNITED STATES ARMY,

WASHINGTON, D.C., February 7, 1896.

Mr. J. L. P. O'HANLY, C.E.,

Care Department of Marine and Fisheries.

Ottawa, Canada.

SIR,—Your letter of the 3rd instant is received, and in reply to your inquiry relative to the gaugings of the St. Clair river, suggested by the Board of Engineers appointed to report on the probable effect of the Chicago Drainage Canal on the levels of the Great Lakes, I have to say that the work of gauging the St. Clair river has not as yet been undertaken.

By direction of the Chief of Engineers.

Very respectfully, your obedient servant,

A. MacKENZIE,

Lieut.-Col., Corps of Engineers.

SESSIONAL PAPER No. 19a

FIRST INTERIM REPORT OF THE AMERICAN SECTION.

INTERNATIONAL WATERWAYS COMMISSION,
(Office of American Section),
328 FEDERAL BUILDING,
BUFFALO, N.Y., December 1, 1905.

MR. SECRETARY,—1. The American section of the International Waterways Commission has the honour to submit the following progress report:—

2. The River and Harbour Act, approved June 13, 1902, contained the following provision, viz.:—

'Section 4. That the President of the United States is hereby requested to invite the Government of Great Britain to join in the formation of an international commission, to be composed of three members from the United States and three who shall represent the interests of the Dominion of Canada, whose duty it shall be to investigate and report upon the conditions and uses of the waters adjacent to the boundary lines between the United States and Canada, including all of the waters of the lakes and rivers whose natural outlet is by the River St. Lawrence to the Atlantic ocean; also upon the maintenance and regulation of suitable levels, and also upon the effect upon the shores of these waters and the structures thereon, and upon the interests of navigation by reason of the diversion of these waters from or change in their natural flow; and, further, to report upon the necessary measures to regulate such diversion, and to make such recommendations for improvements and regulations as shall best subserve the interests of navigation in said waters. The said Commissioners shall report upon the advisability of locating a dam at the outlet of Lake Erie, with a view to determining whether such dam will benefit navigation, and if such structure is deemed advisable, shall make recommendations to their respective governments looking to an agreement or treaty which shall provide for the construction of the same, and they shall make an estimate of the probable cost thereof. The President, in selecting the three members of said Commission who shall represent the United States, is authorized to appoint one officer of the corps of engineers of the United States Army, one civil engineer well versed in the hydraulics of the great lakes, and one lawyer of experience in questions of international and riparian law, and said Commission shall be authorized to employ such persons as it may deem needful in the performance of the duties hereby imposed; and for the purpose of paying the expenses and salaries of said Commission, the Secretary of War is authorized to expend from the amounts heretofore appropriated for the St. Marys' river at the Falls the sum of twenty thousand dollars, or so much thereof as may be necessary to pay that portion of the expenses of said Commission chargeable to the United States.

3. The invitation here authorized was duly communicated to the Government of Great Britain by the American Ambassador in London by letter dated July 15, 1902 (copy appended, marked 'A,' page 120), and was accepted by letter from the British Foreign Office, dated June 2, 1903. The American members were appointed October 2, 1903; they were Colonel O. H. Ernst, Corps of Engineers, United States Army; Mr. George Clinton, of Buffalo, N.Y., and Prof. Gardner S. Williams, of Ithaca, N.Y. The Canadian members were appointed on January 7, 1905; they were Mr. W. F. King, Chief Astronomer, of Ottawa: Mr. J. P. Mabee, K.C., Toronto, and Mr. Louis Coste, C.E., of Ottawa.

4. The American section held its first meeting in Washington, D.C., May 10, 1905, and organized by the election of Colonel Ernst as chairman. The scope of the investigations to be undertaken was defined in a letter from the Department of State, dated April 15, 1905 (copy appended, marked 'J', page 125), from which the following is an extract, viz.:—

'The wording of the law will be seen by reference to the inclosed copy. The department's opinion is that the words "including all of the waters of the lakes and rivers whose natural outlet is by the River St. Lawrence to the Atlantic ocean," are intended as a limitation on what precedes them, and that the investigation and report should only cover such waters, omitting the lower St. Lawrence itself, as well as all other waters not discharging naturally through it.

'The broader interpretation given to the Act by the Canadian authorities should be rejected, if for no other reason, on account of the smallness of the appropriation for the support of the American section. Congress could hardly have intended to provide, with a sum of $20,000 for the expenses incident to an investigation extending to the Pacific coast, and possibly embracing the Alaskan boundry as well.'

It was learned informally that the British government objected to this limited interpretation of the law and had requested a reconsideration of the question, and that the matter had been referred to the Attorney General. In a conference with the Honourable Secretary of War, it was decided that the work of the commission should be under the War Department. It was also decided to invite the Canadian members to join in the first full meeting of the commission in this city, to be held May 25, and an invitation was issued accordingly by the Department of State at the request of the Secretary of War.

5. On May 25, the full commission held its first meeting in this city, and organized by the election of Colonel Ernest as chairman of that meeting, it being agreed that at meetings of the full commission held on American territory the chairman of the American section should preside, and at meetings held on Canadian territory the Chairman of the Canadian section should preside. The commission remained in session during the 25th and the following day, discussing the organization, permanent place of meeting, and scope of their duties. It was decided that for the present the offices of the Canadian section should be established in Toronto, and those of the American section in Buffalo, and that full meetings should be held in one or the other city, as should be found most convenient.

6. The American section having presented the instructions under which they were acting, quoted above, the Canadian section presented the following memorandum, viz:—

'The Canadian members of the International Waterways Commission had understood the scope of the commission to be wider than the American members regard it, and that any misunderstanding may be avoided desire briefly to state the position they have understood matters to be in.

'The invitation to His Majesty's government through the American Ambassador in London, was "for the appointment of an international commission, to be composed of three members from the United States and three who shall represent the Dominion of Canada, whose duty it shall be to investigate in general the waters adjacent to the boundary line between the United States and Canada, the effect upon the shores produced by changes in the water levels, and the erection and location of a dam at the outlet of Lake Erie."

'In due course, by a report of the Committee of the Privy Council of Canada, approved by the Governor General of Canada, it was resolved "that His Majesty's government accept the invitation to co-operate in the formation of the commission." This report, after further reciting that as the subjects to be dealt with pertained to "the regulations of the waters adjacent to the international

boundary," the matter, in so far as Canada was concerned, should be under the Department of the Interior and the Department of Public Works.

'Some regrettable but unavoidable delay in completing the Canadian section of the commission arose by the long-continued illness of the Honourable the Minister of Public Works for Canada.

In the despatch to the government of Great Britain naming the American Commissioners, the invitation to His Majesty's government is again recited as being one to form an international commission to investigate and report upon the conditions and uses of the waters adjacent to the boundary lines between the United States and Canada.

'After the appointment of the Canadian Commissioners, the Prime Minister of Canada, Sir Wilfrid Laurier, in communicating the matter to the Canadian House of Commons, in January last, dealt with the subject-matter of the commission as covering all waters adjacent to the boundaries of the two countries, and in the course of his speech made the following statements: "In sections of the country where the boundary is not water, but land, there are streams and large rivers which have their sources in one country and which flow into another. Complaint has been made by the United States that Canadians have constructed some works upon rivers which have their sources in Canada and which flow into the United States, and that these works affect the flow of the waters in their country. We also have made complaints to the United States that Americans have constructed upon some rivers, the St. John river, for instance, works which affect the flow of the waters in our country. It is, therefore, to the mutual interest and advantage of both countries to have this question properly investigated with a view of having concurrent legislation, if such should be found necessary. From olden times it has been a principle of Roman law, which has been adopted by most civilized nations, that the riparian owner of any stream has the right to used the water of that stream for his own benefit, provided he does not impair the flow of the water beyond the boundary of his property. This is a principle of law which dominates in almost every country; but it is not possible to have this principle followed and carried out when the works are in one country and the boundary of the property is in another country. For these reasons we have thought it advisable to respond to the invitation of the United States to have this question investigated. We have agreed to a commission to be composed of six members, three to represent the government of the United States and three to represent the government of Canada."

'If the inquiries of the commission are to be limited to the waters of the Great Lakes only, it would seem tha the government of Canada has been under misapprehension as to thee dsires and intentions of the government of the United States, and we regard it as our duty to report to our government the limitations expected to be placed upon the scope of the commission, and we respectfully suggest that further action should be delayed until we may be advised to the views of the government of Canada upon the premises'

7. The chairman of the American section stated that he was informed that the British government had communicated with the American government, through diplomatic channels, requesting that the broader interpretation above described be given to the law of congress providing for the commission, and that the American government then had the matter under consideration, but that some days would probably elapse before a decision could be expected. It was then decided that further proceedings be deferred until further instructions be received from the two governments. It was agreed that the decision of the American government should be communicated to the chairman of the Canadian section as soon as received, and that if it be favourable to the Canadian interpretation of the law, or if it be unfavourable, and be accepted by the Canadian government, then a meeting of the commission should be called on Canadian

territory by the chairman of the Canadian section at as early a date as the other duties of the members would permit.

8. The decision of our government was given in a letter dated May 31, 1905, from the Department of State to the British Ambassador at this capital (copy appended, marked 'D' page 129), and was in effect to leave the instructions to the American members unaltered. It was immediately communicated to the Canadian section by letter, dated June 2, 1905 (copy appended, marked 'Q,' page 32), and was by them laid before the Canadian government, which government, after due consideration, authorized the Canadian members to proceed with the work of the commission within the field prescribed to the American members. See letter from the chairman of the Canadian section, dated June 7, 1905 (copy appended, marked 'R,' page 133).

9. The American section then proceeded to complete its organization. Through the courtesy of the Honourable Secretary of the Treasury, excellent quarters in the Federal Building, in Buffalo, were assigned to its use, completely furnished and arranged with temporary partitions to suit its convenience in every respect. These rooms became available September 11. The section was fortunate enough to secure the services, as secretary, of Mr. L. C. Sabin, a hydraulic engineer of many years experience on the Great Lakes in the service of the government. He reported for duty August 1. Professor Williams, finding that business engagements, contracted since his appointment in October 1903, would interfere with his performance of duty as a member of the commission, tendered his resignation, and was replaced by Mr. G. Y. Wisner, civil engineer, appointed June 8, 1905.

10. The full commission held its second meeting at Toronto, June 14 and 15, 1905. Among the questions brought to the attention of the commission at this meeting were the following, viz.:—

(*a*) The uses of the waters at Sault Ste. Marie for power purposes, and the regulations necessary to insure an equitable division of the waters between the two countries and the protection of the navigation interests.

(*b*) The uses of the waters in the Niagara river for power purposes, and the regulations necessary to insure an equitable division of the waters between the two countries, and the protection of Niagara falls as a scenic spectacle.

(*c*) The alleged differences in the marine regulations of the two countries with respect to signal lights, and the advisability of adopting uniform signals for both countries.

(*d*) The advisability of building controlling works at the outlet of Lake Erie, including the effect upon the levels of the lakes and upon their shores, and upon the River St. Lawrence.

(*e*) The diversion southward by the Minnesota Canal and Power Company, of Duluth, of certain waters in the state of Minnesota that now flow north into the Rainy river and the Lake of the Woods.

(*f*) The effect of the Chicago Drainage canal upon the levels of Lake Michigan, Huron, Erie and Ontario, and upon the River St. Lawrence.

(*g*) Deliminating the international boundary on the international waterways and delineating the same on modern charts.

11. At subsequent meetings the following additional questions were brought to the attention of the commission, viz.:—

(*h*) The suppression or abatement of illegal fishing on the Great Lakes.

(*i*) The location and construction of common channels.

(*j*) Regulations to govern navigation in narrow channels.

(*k*) Protection of shores from damages due to deepening of channels and increased speed.

12. It was immediately evident that, in addition to collecting the data known to exist bearing upon these questions, it would be expedient for the com-

mission to make its existence known to the persons most interested in the international waterways, to receive suggestions from them, and to visit in person some or all of the principal localities concerned, giving public hearings where such hearings were desired by the local business interests.

13. On July 7 the commission paid a visit of courtesy to the Canadian government, at Ottawa, and were the recipients of many graceful attentions from the authorities. Between July 9 and 13 the commission passed over the St. Lawrence river and canals from Quebec to Kingston, using the steamer *Frontenac*, kindly placed at their disposal by the Canadian government. During August, a majority of its members visited the Detroit, St. Clair and St. Marys rivers, and the Sault Ste. Marie. Between September 11 and 14, the full commission made an inspection of the outlet of Lake Erie, including Buffalo harbour and Niagara river above the falls, and of the water-power development at Niagara falls. Public hearings were held at Montreal, July 11; at Kingston, July 13; at Niagara Falls, September 14; at Toronto, September 15; at Hamilton, Ontario, September 16; and at Buffalo, November 10.

14. The meetings of the full commission were held at Buffalo, October 27 and 28 and November 10 and 11. To enable all persons to appear before the commission or to address it, who desire to do so, public notice of all meetings is given as long in advance as possible, through the press of the principal cities of the Great Lakes and St. Lawrence system.

15. Of all the questions brought to the attention of the commission, those most pressing for consideration were the questions relating to the uses of water at the Sault Ste. Marie. The situation there, in brief, is this: The volume of water flowing out of Lake Superior is, at normal low water elevation 601, about 64,000 cubic feet per second. Lower stages and a lower discharge have sometimes occurred. On either side of the rapids is a navigation canal, constructed by the United States and Canadian governments respectively.

The traffic through these canals has reached enormous proportions, and is increasing. It is larger this year than ever before, and will greatly exceed 40,000,000 tons for the year. The quantity of water consumed in the operation of the canals during the eight months of navigation is about 1,200 cubic feet per second. The quantity required in the future will be greater. Not less than 4,000 cubic feet should be unconditionally reserved for canal uses, and in granting power privileges, the respective governments should not forfeit the right to increase the amount indefinitely. It may be remarked, in passing, that raft navigation over the rapids has so greatly diminished and it is now so small in amount that the quantities of water above mentioned will suffice to provide for it. This leaves about 60,000 cubic feet which may be temporarily used for power purposes.

16. On the Canadian side the Lake Superior Power Company has a power canal in operation which has a capacity of about 9,000, and is using about 7,000 cubic feet per second. This company has designed an additional canal, not yet constructed, which will have a capacity of about 23,000 cubic feet per second. On the American side the Michigan Lake Superior Power Company has in operation a power canal, which has a capacity of about 31,000, and is using about 8,500 cubic feet per second. This canal takes the water from the St. Marys river above the rapids, conducts it through the city of Sault Ste. Marie, Michigan, and empties it about a mile below the rapids. On the American side also the Chandler-Dunbar Company, owning a portion of the shore line adjoining the rapids, have in operation power works using about 1,400 cubic feet per second. This company is engaged in altering and improving its works in the bed of the stream, under revocable permits from the War Department.

Under permits thus far granted, the consumption of water will be increased to about 3,000 cubic feet per second, but in March, 1902, the company applied

for a permit to build a dike downstream from the fourth pier, counting from the American side of the international bridge in a direction nearly parallel with the shore, to connect with a power-house extending out an equal distance into the stream. A rival company, the St. Marys Power Company, applied in March, 1903, for permission to construct a power canal by means of two parallel dikes extending downstream and a short distance upstream, from the third and fifth piers of the bridge with corresponding power-house. Neither of these latter requests was granted, but they show what the intentions of the companies are, if they be permitted to carry them out. Evidently there is not water enough to carry out all of these schemes. An understanding must be reached by which there shall be an equitable division of the surplus water between the two sides of the boundary. The division between rival companies fortunately for the commission, may be left to the courts of law.

17. The applicants to the War Department of the United States from the American companies for further privileges and an application from the Lake Superior Power Company to the Canadian government for additional authority, led the commission, at its session of October 28, to pass the following resolution, of which copies were sent to the Secretary of War of the United States and the Minister of Public Works of Canada, viz.:—

'Resolved, That in the opinion of the commission, no further right or privileges should be granted or conferred regarding the uses or diversions of the water flowing out of Lake Superior, by either the government of the United States or Canada, until all data and information are in the hands of the commission that may be necessary to enable it to make suggestions for regulating the excess of these waters, or that, if such rights or privileges be granted, they be subject to any regulations that may be adopted by both governments.

18. The use of water for power purposes must be so regulated as not to affect injuriously the level of Lake Superior. On the one hand, the level must never be allowed to fall so low as to injure navigation; and on the other hand, it must never be raised so high as to submerge the shores.

19. The Act of Congress, approved June 13, 1902, authorized the Michigan Lake Superior Power Company to divert water from St. Marys river above the rapids, with certain conditions, among which is the following, viz:—

'And conditioned further, that said company shall establish, maintain, and operate suitable and sufficient remedial amd controlling works in the rapids of said river, to the approval of the Secretary of War and the Chief of Engineers; and said company shall maintain and operate said canal and works in accordance with any rules and regulations that may hereafter be recommended by any international commission and that shall become operative.'

A full copy of the proviso will be found at page 8. In this legislation the principles were recognized that the use of the water was not granted in any fixed quantity nor for any fixed length of time, but that the Secretary of War could enter upon the property and close the canal in whole or in part at any time to the extent necessary to maintain water levels; also, that it should finally be regulated by an international commission.

In granting permission to the company under this Act to divert water, the Secretary of War established, December 12, 1902, certain regulations (copy appended, marked 'U', page 136), which are still in force and which will probably be used by this commission as a foundation in framing the regulations to be recommended. The fundamental principles on which they are based, and which this commission believes to be sound, are: (1) levels must be maintained; (2) navigation must be protected; (3) the public must reserve the right to use any portion or all of the natural flow in the future.

20. A public hearing at which the parties in interest were given an opportunity to be heard, was held in Buffalo, November 10, and at its session of

November 11, 1905, the commission tentatively adopted certain rules and regulations, which it is hoped can be forwarded for approval at an early day.

21. The enforcement of these rules and regulations calls for the executive action from time to time of an international commission. The enforcement of rules to be established hereafter at other places or upon other subjects will probably likewise require joint executive action. It is not clear from the language of the law creating this commission that Congress intended to provide for a permanent international board. It is desirable that the status of the present commission as a permanent executive board be defined or a new board be created.

22. The questions which have been brought to the attention of this commission, enumerated above in paragraphs 10 and 11, cover a wide range of subjects. Some of them clearly come under the jurisdiction of the commission as constituted, while some do not, and about others there is room for doubt. The Canadian members of the commission are ready and anxious to consider all of these questions and to extend the jurisdiction of the commission to all international waters between the Atlantic and Pacific oceans. It is desirable that the wishes of Congress in this matter be more clearly defined.

23. Since it completed its organization in September, the commission has made good progress in the collection of data bearing upon some of these questions, particularly those relating to the use of water at Niagara Falls, and to the regulation of the level of Lake Erie by works near its outlet. With reference to the former, although not ready to report, it though proper to pass, at its session of October 28, the following resolution, of which copies were sent to the Secretary of War of the United States, and the Minister of Public Works of Canada, viz.:—

'Resolved, That this commission recommends to the governments of the United States and Canada that such steps as they may regard as necessary be taken to prevent any corporate rights or franchises being granted or renewed by either Federal, State or Provincial authority for the use of the waters of the Niagara river for power or other purposes, until this commission is able to collect the information necessary to enable it to report fully upon the "conditions and uses" of those waters to the respective governments of the United States and Canada.'

24. To enable it to continue its investigations, an additional appropriation will be required.

Very respectfully,-

(Signed) O. H. ERNST, *Chairman, American Section.*

(Signed) GEORGE CLINTON,

(Signed) GEORGE Y. WISNER, *Members, American Section.*

Hon. Wm. H. Taft, Secretary of War, Washington, D.C.

1906

SECOND INTERIM REPORT OF THE CANADIAN SECTION OF THE INTERNATIONAL WATERWAYS COMMISSION.

Ottawa, Ontario, April 25, 1906.

Honourable C. S. Hyman,

Minister of Public Works,

Ottawa, Ont.

Sir,—The Canadian members of the International Waterways Commission have the honour to submit the following report:—

At the last joint meeting of the International Waterways Commission, held in Toronto, on March 6 and 7, 1906, the chairman of the American section presented the following letter:—

Department of State,

Washington, February 13, 1906.

The Honourable Secretary of War,

Sir,—Several months ago the State Department and the British Ambassador took up the subject of a possible treaty between the United States and Great Britain relating to the use of the waters of the Niagara river and the preservation of the falls.

On November 13, the ambassador transmitted to the department a report of the Canadian Privy Council approved November 2, 1905, to the effect that a report from the Canadian section of the Waterways Commission stated that the commission was studying the subject, and expected to be able to make a joint report to the government of the United States and to the government of Canada before long, recommending the adoption of rules and regulations which would prevent, in the future, the destruction of Niagara falls by the use of its waters by manufacturers.

In the report of the American section, made to the Secretary of War on December 1, 1905, occurs the following statement: 'The commission have made good progress in the collection of data bearing upon some of these questions, particularly those relating to the use of water at Niagara falls.'

On October 20, 1905, the commission appears to have adopted the following resolution:

'Resolved, that this commission recommends to the governments of the United States and Canada that such steps as they may regard as necessary to be taken to prevent any corporate rights or franchises being granted or renewed by either federal, state or provincial authority, for the use of the waters of the Niagara river, for power or other purposes, until this commission is able to collect the information necessary to enable it to report fully upon the "conditions and uses" of those waters to the respective governments of the United States and Canada.'

The negotiation relating to a treaty on this subject has been suspended awaiting the further report of the commission, in accordance with the statements to which I have referred, There are many indications of active public interest

in this subject, and a joint resolution having in view the preservation of the falls, pending in the House of Representatives, has been favourably reported by the Committee on Rivers and Harbours. The indications are that if an agreement can presently be reached between the two countries as to the action necessary to accomplish the purpose, any legislation to give the agreement effect on the part of the American authorities would receive favourable consideration at the present session of Congress and at the present session of the New York legislature.

It seems desirable, therefore to press forward the negotiations for such an agreement without any avoidable delay. May I ask you to make such a report upon the subject as may furnish a basis upon which the State Department and the ambassador may take and proceed with the negotiations?

I have the honour to be, sir,

Your obedient servant,

ELIHU ROOT.

The American section then urged that the question of the preservation of Niagara falls be taken up, before all other subjects, as being more immediately pressing.

The commission spent two days considering the details of a report upon the conditions at Niagara Falls. When the commission had partly agreed upon the facts, a series of recommendations was suggested by the American section, to the effect that a treaty be concluded between the two countries, wherein it should be agreed to preserve for all time the scenic beauty of Niagara, by pledging each country to cancel all charters, other than those under which works had been actually constructed, and by agreeing to prohibit all other diversion of water which is naturally tributary to Niagara falls, except such as may be required for domestic use and for the service of locks in navigation canals.

The Canadian section opposed any hasty action, and an adjournment was made until April 26, at Washington.

Intimation was given at the meeting that unless the Joint Commission was prepared to report promptly, the American section might be called upon to give an independent report, in compliance with the following resolution which had been submitted to Congress:

'Resolved, by the Senate and House of Representatives of the United States of America, in Congress assembled, that the members representing the United States upon the International Commission, created by section four of the River and Harbour Act, of June 13, 1902, be requested to report to Congress at an early date what action is, in their judgment, necessary and desirable, to prevent the further depletion of water flowing over Niagara falls; and the said members are also requested and directed to exert, in conjunction with the members of the said commission representing the Dominion of Canada, if practicable, all possible efforts for the preservation of the said Niagara falls in their natural condition,' and that in that case, it was likely that action would be taken looking to the negotiation of a treaty without further reference to our Joint Commission, and on March 19, the American section made a report to the Secretary of War, which has been transmitted to Congress by the President of the United States, by message, dated March 27 (copy of which is hereby appended, marked 'A').

In order that you may understand the situation, we desire to give you a short summary of the facts and conditions, as they now present themselves to us:

The volume of water discharged at Niagara falls varies from 180,000 cubic feet per second at low stage of Lake Erie, to 280,000 cubic feet per second at high stage of the lake, the mean discharge being 222,400 cubic feet per second at mean level of Lake Erie (elevation 572·86).

There are now five companies engaged in furnishing, or preparing to furnish, electricity, two located on the American side and three on the Canadian side of the river, above the falls.

The American companies, when in full operation, will develop about 340,000 horse-power, and use about 26,400 cubic feet of water per second, while the companies on the Canadian side, will have a capacity in all, of about 415,000 horse-power, and use about 32,100 cubic feet of water per second; the result being that from 27 to 33 per cent of the total volume of water which would otherwise go over the falls will be used for power purposes.

It is conceded by the American section that as the diversions of water on the Canadian side are made at or below the crest of the rapids, they do not affect, in any degree, the flow over the American fall.

The opinion of experts is that when these works are in full operation, while there will be a noticeable diminution of the water flowing over the falls, it will not have the effect of destroying or seriously impairing the scenic beauty of the falls; indeed, our own engineer is of the opinion that while the limit of development has been reached, even exceeded on the American side, a considerably larger use could be made for power development on the Canadian side, without injury to the falls. With this latter contention, the American engineer does not now agree. Both, however, are of the opinion that this latter question can be much more definitely and properly settled when the consequence of the present developments has become apparent.

Both the companies whose works are on the American side of the river, viz.: The Niagara Falls Hydraulic Power and Manufacturing Company, and the Niagara Falls Power Company, will distribute all their power in the United States. Two of the companies on the Canadian side, viz.: The Canadian Niagara Power Company, and the Ontario Power Company, intend using a large part of their power on the American side. In fact, the former has laid a wire on the traffic bridge, immediately below the falls, and intends laying wires across the river between Fort Erie and the city of Buffalo. The latter company has laid wires across the river at a point above Lewiston, known as the Devil's hole. Neither of these two companies has made any serious effort to distribute its power in Canada. The third company, the Electrical Development Company, are erecting transmission lines as far as Toronto, and intimate their intention to build other lines to supply the western section of the province as far as London.

The Cataract Power Company, who take their water from the Welland Canal and use the escarpment at DeCew's falls, is the only other company operating in the same section; they are at present developing about 14,000 horse-power, and use 600 cubic feet per second. This company, together with the Electrical Development Company, can supply all the immediate Canadian demand.

The only condition in the agreement between the Park Commissioners and the three companies operating on the Canadian side at the falls, relating to exportation of power, is as follows:—

'(II.) The company, whenever required, shall, from the electricity or pneumatic power generated under this agreement, supply the same in Canada (to the extent of any quantity not less than one-half the quantity generated), at prices not to exceed the prices charged to cities, towns and consumers in the United States, at similar distances from the Falls of Niagara, for equal amounts of power and for similar uses, and shall whenever required by the Lieutenant Governor in Council, make a return of prices charged for such electricity or power, and if any question or dispute arises involving the non-supply or prices of electricity or power for consumption in Canada, the High Court of Justice of Ontario

shall have jurisdiction to hear and determine the same and enforce the facilities to be given or the prices to be charged.'

It will be seen that this provision, possibly does not afford much protection; the companies themselves will not be inclined to build transmission lines in Canada while they have a much better market across the river, and no one on this side is at present in a position to demand power. The provision, in our opinion, creates, however, a moral obligation which your government should put itself in a position to enforce. At present, necessarily, if these companies are to be made to pay dividends they must sell their power where there is a market for it; so that to entirely refuse to allow them to export would be ruinous to them and not justified by the existing conditions. The Park Commission will receive a revenue of about $250,000 a year from the three companies operating under agreements with them. This sum represents a very small proportion indeed of the yearly value of their franchises. It is estimated that the saving in cost of power at the point of production in favour of falling water over any other method is at least $25 per h. p. This benefit should be apportioned in a reasonable degree between the producing companies and the general public. It will be a misfortune if the companies holding Canadian charters are not restricted in their exportation by regulations distinctly understood and accepted, which will compel them to carry out the spirit of their agreements by distributing power in Canada as demand is created, at reasonable prices. In the opinion of this commission adequate returns for their investment can thus be secured to the companies, while at the same time the Canadian public will obtain great advantage from the use of their natural advantage.

If there was a market in our country for one-half the power that could be generated at Niagara, its value put into millions per annum would be startling, but there is no such immediate demand and it seems to your commission that the present purpose of all concerned will be best served by preserving Niagara falls and at the same time making such provisions as are necessary to insure to our people the benefit of all the cheap power required. If we keep ourselves in a position to control the distribution of the power generated on the Canadian side of the river it will enable us to supply the requirements of our people for years to come without any further development.

The Dominion Parliament has granted charters to three corporations which are still in force, viz.: The Niagara Welland Power Company and the Jordan Light, Heat and Power Company, organized for the purpose of diverting water from the Welland river, which water would be taken from the Niagara river by back flow, and the Erie and Ontario Power Company, which would take its water from the Grand river and Lake Erie. These companies seem to be unlimited as regards the quantity of water that they may use or the power they may generate.

Quite irrespective of the question of injury to Niagara falls the charter granted to the Erie and Ontario Power Company is subject to the further serious objection that its operation would have the effect of lowering the level of the water in Lake Erie.

As we already have at Niagara and DeCew's falls a development three times the Canadian demand it would seem to be the sheerest folly to increase the development until our own market requires it. It is very little advantage indeed to this country to develop power which is to be transmitted to the United States. We are, therefore, of opinion that it would be wise to enter into an arrangement with the United States, limiting the amount of water to be used on the Canadian side at Niagara river and elsewhere on the Niagara peninsula to 36,000 cubic feet per second. This will permit of the completion of the works now in operation on the Niagara river to their fullest capacity. It will

also permit the Cataract Power Company to continue its operations and will give us a few thousand cubic feet per second for additional developments.

At Chicago, the Americans have built a drainage canal which, when in full operation, will use about 10,000 cubic feet of water per second.

The quantity of water required for the purposes of a ship canal is comparatively small, but the character of this drainage canal at Chicago is such as to involve a continuous flow of water which will have the effect of lowering Lake Michigan by over six inches, and Lake Erie by four and one-half inches. The nature of this work may be judged when we state that the expenditure will be over forty million dollars, and that power works are in course of construction on the canal which will generate some 30,000 h. p.

As the diversion from Lake Michigan to the Mississippi river is of a much more serious character than the temporary diversions from the Niagara river, it is felt that the amount of water to be taken on the American side of the Niagara river should be limited to 18,500 cubic feet per second.

But, in the opinion of your commission, the preservation of Niagara falls is a minor matter as compared with the preservation of the interests of navigation on the Great Lakes.

Lake Erie, as you know, is a shallow lake and the navigation interests already represented by capital investments of one thousand million of dollars are very much alarmed and are very insistent that the interests of navigation should be paramount and that there should be no further diversion whatever for power purposes which will interfere in any way with the mean level of the lakes. On the other hand, the demand for the use of power is growing every day and the time has come when it is absolutely essential that some dominant hand should intervene as between these conflicting interests and settle how and when, if at all, diversion is to be allowed of these boundary waters for power purposes.

It is exceedingly important in the interests of navigation, both to ourselves and the people of the United States, that the diversion by way of the Chicago drainage canal should be limited. It is equally essential in the interests of both countries that no diversion or interference should be allowed in streams crossing the boundary which would interfere with the interests of navigation in either country. It is all important that while we are settling the policy as to Niagara falls we should at the same time establish certain principles which shall be applied in settlement of all classes of dispute which can arise between the two countries with regard to the use of boundary waters or of streams which cross the boundary from one country to the other.

If our proposal is carried out the diversions will be about as follows:—

DIVERSIONS ON THE AMERICAN SIDE.

	Per Second. Cubic Feet.
Niagara falls	18,500
Chicago drainage canal	10,000
Total	28,500

DIVERSIONS ON THE CANADIAN SIDE.

	Per Second. Cubic Feet.
Niagara falls and on the Niagara peninsula	36,000

It is quite apparent that no further diversions can be made on the Niagara river without injury to the scenic effect of the falls as a whole, and there should be no further diversion from Lake Erie or any other of the waters of the Great Lakes system which will be injurious to navigation. Your commission is,

therefore, of opinion that the time has come when it is desirable to make a treaty limiting these diversions, and we have prepared a series of resolutions which we intend to submit at the next meeting of the joint commission, as follows:

Whereas, in the opinion of this commission it is desirable that the whole question of the uses and diversions of the waters adjacent to the boundary line between the United States and Canada, and the uses and diversions of all streams which cross the international boundary between the said countries should be settled by treaty,

Therefore, this commission recommend that a treaty be had between the United States and Great Britain, in framing which it should be recognized, that:

1. In all navigable waters the use for navigation purposes is of primary and paramount right, and therefore diversions should not be permitted which interfere with such use.

2. The Great Lakes system, on the boundary between the United States and Canada, and finding its outlet by the St. Lawrence to the sea, should be maintained in its integrity, and no diversions of water tributary to such streams should be permitted by either country, except as hereinafter provided.

3. Permanent or complete diversions of such waters are wrong in principle and should hereafter be absolutely prohibited. The diversions by the Chicago drainage canal should be limited to the use of not more than 10,000 cubic feet per second.

4. Diversions of international waters elsewhere than at Niagara river or the Niagara peninsula should only be permitted,

(*a*) For domestic purposes and for the service of locks in navigation canals.

(*b*) Temporary diversions, where the water taken is returned again, only on the recommendation of a joint commission; such diversions not to interfere in any way with the interests of navigation and to be allotted in equal proportions to each country and so that each may have a like benefit.

5. It should be declared to be a principle with relation to the use of all navigable rivers and streams crossing the international boundary that no obstruction or diversion should be permitted, either on such rivers or their tributary streams, which will interfere with navigation in either country.

6. As to the diversions from Niagara river and on the Niagara peninsula:

(*a*) In the opinion of this commission it would be a sacrilege to destroy the scenic effect of Nigara falls unless and until the public needs are so imperative as to compel and justify the sacrifice.

(*b*) It is possible to preserve its beauty and yet permit the development on the Canadian side of the Niagara river itself and elsewhere by diversions on the Niagara peninsula to Lake Ontario of water for power purposes to the extent of not more than 36,000 cubic feet per second, exclusive of water required for domestic uses, and for the service of locks in navigation canals.

(*c*) It is likewise possible to allow the diversion of waters for power purposes on the American side to the extent of 18,500 cubic feet per second, exclusive of the amount required for domestic uses, and for locks in navigation canals, without serious injury to the scenic aspect of the falls.

(*d*) Your commission are of opinion, therefore, that for the present the diversions should be limited to the quantities mentioned in subsections *b* and *c*.

(*e*) This would give an apparent advantage to Canadian interests, but, as the diversion is not of serious injury to the falls and does not materially affect the interests of navigation, it is more than counterbalanced by the complete diversion of 10,000 cubic feet by way of the Chicago drainage canal to the Mississippi river.

7. Magnificent as are the scenic effects of the falls of Niagara, the commercial value of the power which its waters can produce is so very great, and the future need may be so pressing, that, in the opinion of your commission, it will be

sufficient that a treaty with regard to the diversions there should be limited to the period of twenty-five or thirty years.

8. As to non-navigable streams flowing in either direction across the international boundary line, diversion for irrigation or other than 'innocent uses', be allowed so that each country shall have an equal benefit from such diversions and that a joint commission shall have power to deal with and regulate such uses.

Suggestions have been made that the mean level of Lake Erie can be raised by the erection of a dam at the mouth of the Niagara river, but to this course strong objection is made by the parties in interest at Montreal and elsewhere who apprehend that the result would be to lower the level of Lake Ontario and the St. Lawrence river. It is admitted on all sides that if such will be the effect the work cannot go on. Your commission in due course will be able to report upon this important question.

Respectfully submitted,

(Signed) GEO. C. GIBBONS,
Chairman Can. Section.

(Signed) LOUIS COSTE,

(Signed) W. F. KING,
Members Can. Section.

(Signed) THOS. COTE,
Secretary Can. Section.

JOINT REPORT OF THE COMMISSION ON THE CONDITIONS EXISTING AT NIAGARA FALLS, WITH RECOMMENDATIONS.

BUFFALO, N.Y., May 3, 1906.

The Honourable, the Minister of Public Works of Canada, and the Honourable, the Secretary of War of the United States:

The International Waterways Commission has the honour to submit the following report upon the preservation of Niagara falls:—

The commission has made a thorough investigation of the conditions existing at Niagara falls, and the two sections have presented reports to their respective governments setting forth these conditions, to which attention is invited. The following views and recommendations are based upon a careful study of the facts and conditions set forth in these reports:

1. In the opinion of the commission, it would be a sacrilege to destroy the scenic effect of Niagara Falls.

2. While the commission are not fully agreed as to the effect of diversions of water from Niagara falls, all are of the opinion that more than 36,000 cubic feet per second on the Canadian side of the Niagara river or on the Niagara peninsula, and 18,500 cubic feet per second on the American side of the Niagara river, including diversions for power purposes on the Erie canal, cannot be diverted without injury to Niagara falls as a whole.

3. The commission, therefore, recommend that such diversions, exclusive of water required for domestic use or the service of locks in navigation canals, be limited on the Canadian side to 36,000 cubic feet per second, and on the

United States side to 18,500 cubic feet per second (and in addition thereto, a diversion for sanitary purposes not to exceed 10,000 cubic feet per second, be authorized for the Chicago Drainage canal), and that a treaty or legislation be had limiting these diversions to the quantities mentioned.

The effect of the diversion of water by the Chicago Drainage canal upon the general navigation interests of the Great Lakes system will be considered in a separate report.

The Canadian section, while assenting to the above conclusions, did so upon the understanding that in connection therewith should be expressed their view that any treaty or arrangement as to the preservation of Niagara falls should be limited to the term of twenty-five years and should also establish the principles applicable to all diversions or uses of waters adjacent to the international boundary, and of all streams which flow across the boundary.

The following principles are suggested:

1. In all navigable waters the use for navigation purposes is of primary and paramount right. The Great Lakes system on the boundary between the United States and Canada and finding its outlet by the St. Lawrence to the sea should be maintained in its integrity.

2. Permanent or complete diversions of navigable waters or their tributary streams, should only be permitted for domestic purposes and for the use of locks in navigation canals.

3. Diversions can be permitted of a temporary character, where the water is taken and returned back, when such diversions do not interfere in any way with the interests of navigation. In such cases each country is to have a right to diversion in equal quantities.

4. No obstruction or diversion shall be permitted in or upon any navigable water crossing the boundary or in or from streams tributary thereto, which would injuriously affect navigation in either country.

5. Each country shall have the right of diversion for irrigation or extraordinary purposes in equal quantities of the waters of non-navigable streams crossing the international boundary.

6. A permanent joint commission can deal much more satisfactorily with the settlement of all disputes arising as to the application of these principles, and should be appointed.

The American members are of opinion that the enunciation of principles to govern the making of a general treaty is not within the scope of their functions; moreover the jurisdiction of the American members is restricted to the Great Lakes system.

GEO. C. GIBBONS,
Chairman, Canadian Section

O. H. ERNST,
Colonel, Corps of Engineers, U.S.A., Chairman, American Section.

W. F. KING,
Commissioner.

GEORGE CLINTON,
Commissioner.

LOUIS COSTE,
Commissioner.

GEO. C. WISNER,
Commissioner.

THOS. COTE,
Secretary, Canadian Section.

L. C. SABIN,
Secretary, American Section.

SESSIONAL PAPER No. 19a

REPORT ON THE CONDITIONS EXISTING AT SAULT STE. MARIE, WITH RULES FOR THE CONTROL OF THE SAME, RECOMMENDED BY THE INTERNATIONAL WATERWAYS COMMISSION.

BUFFALO, N.Y., May 3, 1906.

The Honourable, the Minister of Public Works of Canada, and the Honourable, the Secretary of War of the United States:

The International Waterways Commission has the honour to submit the following report upon the conditions existing at Sault Ste. Marie, with rules for the control of the same.

Upon the organization of the International Waterways Commission, it found the most pressing matter coming within its jurisdiction was the regulation of the use by private corporations of the waters of St. Marys river in connection with the control of those waters for the protection of navigation at present and in the future. The commission, therefore, proceeded to an investigation of the local conditions by special committee and the study of all data obtainable. After thorough consideration of all the information which could be obtained, and after hearing all parties interested in the use of the waters at Sault Ste. Marie, including navigation interests, the commission is satisfied that the rules recommended herein, governing the use, or interference with the natural flow, of those waters, will do entire justice to private interests, and, at the same time, fully protect commerce and navigation.

The extent of the commerce on the Great Lakes is well illustrated by official statistics of the amount of freight which passed the locks at Sault Ste. Marie during the season of navigation in 1905, which amounted to more than forty-four million net tons. To this should be added the local tonnage, which is considerable, and the large traffic between ports on Lakes Michigan and Huron and the east, making a total lake traffic of between fifty and sixty million tons. The immense importance of transportation by the Great Lakes, and the consequent necessity of protecting and facilitating it in the interest of the public, becomes apparent when we consider that the ability to transport by lake must have resulted, during the season of 1905, in saving many millions of dollars. The average rate for transportation of Lake Superior freights in 1905 was $.00085 per ton-mile, while from the best information obtainable the transportation rate by rail between Lake Superior point and the east is not less than $.004 per ton-mile. The ton-mile saving over railroad transportation was, therefore, at least, $.00315. The average haul of the freight mentioned was eight hundred thirty-three and three-tenths miles. The total number of tons of freight that passed the Sault locks in 1905 was 44,270,680, and it follows that in this year there was an aggregate saving through lake transportation on Lake Superior, through freight alone, of approximately $116,000,000. In other words, by transporting the Lake Superior freight on the Great Lakes, $116,000,000 were saved, in 1905, to the producers of raw materials, the manufacturer and the consumer, and the saving to manufacturers has made it possible for them to supply the home markets and compete in those of foreign countries.

The growth of commerce upon the Great Lakes in the past few years, and its prospective immense increase in the future, has convinced the commission that steps should be taken, not merely to preserve the lake levels, but to retain absolute control of all waters which go to maintain those levels, and of all lands which may be useful or necessary, at present or in the future, to increase navigation facilities. The commission is therefore, decidedly of the opinion that the governments of the United States and Canada should act in unison in controlling, absolutely, any and all diversions at Sault Ste. Marie, so that the waters of the river may be available at any time when needed for navigation.

ST. MARY'S RIVER.

Our investigation of conditions at Sault Ste. Marie developed the following fact:

The St. Marys river forms the connecting channel between Lake Superior and Lake Huron. In its length of sixty-four miles the total fall has varied, in recent years, from 21 to 23 feet; of this total fall, from 18 to 20 feet is found in a distance of three-fourths of a mile at the rapids at Sault Ste. Marie. The entire run-off of the Lake Superior drainage basin, having an area of 76,100 square miles, passes the St. Marys river, giving an average discharge of about 70,000 cubic feet of water per second. As this river forms the only means of water communication between the important industries of the Lake Superior regions and the eastern markets, the advisability of its improvement for navigation purposes was early recognized. In 1885 the first canal and lock capable of passing lake vessels was completed, at a cost of about one million dollars. There were two tandem locks, each seventy feet wide, three hundred and fifty feet long, having a lift of about nine feet each, with a depth of eleven and one-half feet of water on the mitre sills. The great increase in the number and size of boats passing through the St. Marys river necessitated the construction, in 1870, of the Weitzel lock. This lock completed in 1881, and still in service, is five hundred and fifteen feet long, eighty feet wide in the chamber, and has about fourteen feet of water over the mitre sills at ordinary low water level.

The increase of lockage facilities did not accommodate the rapid increase in the size and number of vessels necessitated by the constant increase of the commerce which passed through the river, and as a result it became necessary to construct another lock on the American side. Accordingly what is known as the Poe lock, was built. It has a chamber eight hundred feet long, one hundred feet wide and a depth of about nineteen feet at ordinary low water.

It was supposed the Poe lock would accommodate the commerce of Lake Superior for many years. But it, together with the Weitzel lock and the Canadian lock, hereinafter described, has at times proved inadequate for proper despatch of the lake vessels passing the rapids, and it is quite evident that in the near future further lockage facilities must be furnished to meet the demands of commerce.

On the Canadian side of the river a lock nine hundred feet long, sixty feet wide, and having about nineteen feet of water on the mitre sills at ordinary low water, has been constructed. It was completed before the Poe lock. There are several vessels now navigating the lakes, which this lock cannot accommodate, their beam being 60 feet or more.

The improvement of the St. Marys river below the locks has been almost continuous, and consists of the clearing of channels, and the construction of the so-called 'Hay Lake Channel.' An available depth of from 17½ to 19 feet, depending on the stage of water, has been obtained. At present the United States government is engaged in deepening the channels to a depth of 21 feet at low water, and in constructing a new channel through the West Neebish, which will furnish an additional passage connecting Hay lake with Mud lake. This channel will have a least width of 300 feet, and low water depth of 21 feet, or sufficient to accommodate all vessels now navigating the river. These improvements have cost the government of the United States about fourteen millions of dollars and the government of Canada about five millions.

The increase in the size of vessels navigating the lakes, has been rapid. In 1890, lake vessels reached a length of 300 feet, in 1896, 400 feet, in 1902, 500 feet, and six vessels 600 feet in lenth will be put in service during 1906. In 1904 there were only forty boats in the Lake Superior trade, with a capacity of 8,000 tons or more, while thirty-two additional vessels will be in commission during 1906, none of which will have a cargo capacity of less than 8,000 tons. The

combined cargo capacity of these thirty-two new boats will be about 338,000 tons for a single trip, and they will constitute an addition of about twenty per cent to the carrying capacity of the fleet engaged in the transportation of ore from Lake Superior.

The quantity of freight passing to and from Lake Superior has doubled twice in the past thirteen years, it being 44,270,680 tons in 1905, about four times what it was in 1892. The value of the cargoes passing the Sault canals in 1905 was $416,965,484; iron, including ore and manufactured iron, constituting twenty-seven per cent of this value, and cereals twenty-eight per cent.

It is estimated that the present lockage system is capable of giving what may be considered reasonably prompt service, if not required to pass more than fifty million tons during the season of navigation, but if called upon to pass more than sixty million tons, delays, which are not infrequent now, will become excessive, and cause great financial loss. In view of the past growth of this commerce, it is extremely hazardous to predict its extent in the future, but a conservative estimate indicates that before another lock can be completed the limit of traffic for prompt service will have been passed. In this connection we would call attention to the fact that the largest classes of boats existing, and now being rapidly built, are already restricted in carrying capacity on account of deficient available depth of water, and are subject to delays because not more than one of them can be passed through the largest lock at one time. In addition to this, many of the largest boats now navigating the lakes are limited to the use of the Poe, and the Canadian locks, on account of their size. The rate of increase in traffic and in the size of boats, in the future, judging from the experience of the past, and the predictions of those conversant with the subject, will make the present lockage system inadequate before lockage facilities can be increased. The loss, financially, which would result from not furnishing means of passage around the rapids adequate to the demands of commerce, or in case of accident to any of the existing locks, from delay until repairs could be made, would be incalculable.

The canal leading to the American locks from the upper river is 4,200 feet in length, and has an average cross section of about 5,000 square feet. Its width at the narrowest part is only 108 feet, it being crossed at that place by the swing span of the International bridge. The sides of this canal are frequently lined with vessels awaiting down passage when vessels are leaving the locks to pass into Lake Superior. The manœuvring of boats going in opposite directions in such a narrow passage is very difficult, and is accompanied by possibility of accident. The conditions are seriously aggravated by a strong current, which occurs in the canal whenever the locks are filled. Plans have been made by the United States government for enlarging this canal, doubling its width at the narrowest place, and increasing the width at other points. This would relieve the situation at present, but it is quite apparent that provision should be made for further widening, so that when a new lock shall have been constructed, two or more locks may be filled at the same time without creating a violent current. This will necessitate the acquisition of more land on the river side than is now owned by the United States.

The Canadian canal is about 6,000 feet long, from 143 to 156 feet wide, and something over 22 feet deep. The Canadian lock above mentioned is at the eastern extremity of this canal. The same general considerations apply to this canal and lock that we have presented in connection with the American canal and locks.

WATER POWER DEVELOPMENTS.

The development of the power of the St. Marys rapids has been projected and carried on by practically two interests: the Chandler-Dunbar and allied

interests, and the Lake Superior Corporation with its subordinate companies, the Lake Superior Power Company and the Michigan Lake Superior Power Company.

In 1883 Wm. Chandler was granted letters patent for a strip of land about 3,000 feet in length, lying along the north side of the St. Marys Falls canal, adjoining the rapids on the American side of the river. In 1887 the Edison Sault Light and Power Company was organized for the purpose of developing water-power at this point, and the following year a canal, about 2,200 feet long was dug though this property, the power developed being used locally, largely for electric lighting. In 1889 a permit was granted the above company by the government of the United States to extend its tail-race by connecting the lower end of the embankment with Island No. 3, and in 1893 a permit was given for joining Islands Nos. 3 and 4, which lay in front of the lands owned by the United States, thus providing for a tail-race to enable the company to utilize a somewhat greater head than the fall naturally existing in front of the lands located by Mr. Chandler.

In 1892 a permit was granted by the Secretary of War to the Edison Sault Electric Company, the lessee of the Chandler-Dunbar Company, to build an embankment dam from the third pier of the international bridge, extending down stream. The completion of this dam or dyke provided a more commodious head race, and the water-power developed has been increased since that time, as local needs demanded.

In 1901 this permit was modified to provide for the building of a new power-house in front of the lands located by Mr. Chandler, and the construction of a new tail-race outside of Island No. 3, belonging to the United States, on condition that the company should 'abandon the tail-race, now used on the inside of Island No. 3, and relinquish to the United States all rights of the company between said island and the shore.'

In 1903 this permit was again modified so as to allow the company to build out into the rapids of St. Marys river', to remove the power-house and a portion of the embankment dam now in use, and to construct a larger power-house and longer wall to inclose a forebay, and to construct a wider tail-race. Work under this last permit was commenced in the spring of 1905, and is now in progress.

The available head of water on the present works is about 9 feet. The power developed by the turbines is about 750 horse-power. The amount of water used in this development is about 1,400 cubic feet per second, including leakage. The natural fall in the rapids in front of the shore holdings of the company was found to be about 9 feet, when it was measured in the fall of 1903.

The building, in 1892, of the dyke above mentioned, under permit of that year, obstructed the flow through the rapids under two spans of the international bridge, shutting off a water area about 1,915 square feet in cross section.

Work is now progressing under the permits granted by the War Department of the United States, and it is expected that a head of about 13 feet will be obtained, furnishing 4,700 mechanical horse-power by the consumption of 4,000 second feet.

The interests constructing these works claim the right to do so, not only under the permits granted, but, so far as the occupation of the bed of the rapids opposite the Chandler lands is concerned, by virtue of asserted riparian rights appurtenant to the ownership of the adjacent shore. In a litigation now pending, brought by the United States against the Chandler-Dunbar Water Power Company in the western district of Michigan, the District Court has decided that the ownership of the shore lands carries with it the title to the bed of the river, including Islands Nos. 1 and 2, and from this it follows that the right to erect structures in the river to utilize the waters of the river for power purposes as it flows past the riparian owners' land exists, subject merely to the restriction that the structures must not, directly or indirectly, injuriously affect navigation.

The Lake Superior Corporation, through its subordinate companies, the Lake Superior Power Company, organized under the laws of the province of Ontario, and the Michigan Lake Superior Power Company, organized under the laws of the state of Michigan, has constructed canals on both sides of the river, with works for the development of power.

On June 30, 1888, 'The Sault Ste. Marie Water, Gas and Light Company', was incorporated on the Canadian side, under the Revised Statutes of Ontario chapter 164. By Act of 1889, the name of the company was changed to, The Ontario Water, Light and Power Company,' and it was given power to build dams across the island channels or rapids of St. Marys river or any branch thereof within the province of Ontario, and to construct such other works as might be necessary to supply them with the water needed for their operations, such rights to be exercised only with the consent of the Crown or the individual affected.

After partially completing a water-power canal, this company became financially embarrassed, and was not able to continue the undertaking.

In 1895, Francis H. Clergue and his associates took over the property of the old company, including franchises for supplying the town with electric lighting, water and street railway privileges. At the same time the name of the company was changed to 'The Lake Superior Power Company,' and in 1896 a portion of St. Marys island opposite the rapids was granted to the company, in exchange for certain other lands in the town of Sault Ste. Marie, Ont. The Lake Superior Power Company also acquired other lands in the vicinity north of the Canadian ship canal, and at once began the development of water-power. 'The Consolidated Lake Superior Company' was formed in 1901 to consolidate and control the interests of this company, the Michigan Lake Superior Power Company, and many others, and in 1904, it was reorganized under the name of 'The Lake Superior Corporation.'

The canal of the Lake Superior Power Company is about 220 feet wide at the water line, and 12½ feet deep at the head gates, changing gradually to a prism 86 feet wide and 15½ feet deep at the power-house. The present plant is developing about 11,000 horse-power at the turbine shafts. The average amount of water used has been estimated at about 7,000 cubic feet per second, with a maximum of 8,000 cubic feet per second when all wheels are running at full capacity.

In building its works this company occupied the bed of a small stream, running between the islands on the north side of the river, having a water cross section estimated at 1,603 square feet. This company, with its allied company, the Michigan Lake Superior Power Company, to be described below, has also erected remedial works on the Canadian side of the river above the 9th and 10th spans of the international bridge, being the two spans nearest to the Canadian shore, making it possible to nearly stop the flow of water under those spans. The same company has projected a second canal of much larger capacity, work upon which has not been begun.

About 1887, the St. Marys Falls Water Power Company began excavation for a canal through the town of Sault Ste. Marie, Michigan, from a point above the ship canal, to connect with the river below the locks. The company failed, and its right of way was purchased by the Michigan Lake Superior Power Company, incorporated under the laws of Michigan, one of the allied companies subsequently forming the Consolidated Lake Superior Company.

The Michigan Lake Superior Power Company has constructed a canal over two miles in length with a cross sectional area of about 4,300 square feet, extending from above the upper end of the St. Marys Falls ship canal to a point about a mile below the locks, where it debouches into the lower river.

Pursuant to the provisions of the River and Harbour Act, approved June 13, 1902, the Secretary of War of the United States, under date of December 12, 1902, granted the Michigan Lake Superior Power Company a permit for the

diversion of the waters of the St. Marys river through its canal, subject to prescribed regulations based upon the maintenance of proper water levels, including the erection of remedial works. The remedial works have been partially constructed, but owing to the fact that they have not been completed, and to the fact that repairs to the company's power-house and forebay are needed, the full capacity of the canal, 31,200 second-feet, is not used. 8,500 second-feet being the estimated amount actually utilized at present. The remedial works, so far as completed, are those above mentioned, partially covering the spans nine and ten of the international bridge on the Canadian side.

HYDRAULIC CONDITIONS.

The head of the canal at St. Marys rapids is situated about fourteen miles below Point Iroquois, which may be considered the head of St. Marys river. In this fourteen miles there is a fall of only about 0·4 foot. As this slope is so slight it is practically constant for all stages of water level, and the mean level of Lake Superior is directly affected by any changes in level that may occur in St. Marys river above the rapids. The lowest monthly mean level of St. Marys river above the locks, within the past thirty-three years, was in March, 1879, the level being 600·38 feet above mean tide at New York. Since that year it has never been below 601·0 feet during the months of the navigation season, May to November. Since 1893, there has been but one month during the navigation season when the mean level fell below 601.7 feet. Since 1876, the mean level has never been above 603·2 feet.

Previous to the building of the international bridge in 1887, the channel of St. Mary's river at the rapids consisted of the main channel and four small streams running between the islands near the Canadian side. At a water level of 601·7 feet, the cross sectional area of these streams previous to obstruction is estimated to have been about 13,452 square feet for the main channel, and 2,064 square feet for the small streams, giving a total area of section of 15,516 square feet. This cross section has been obstructed from time to time by the following works:—

In 1887 the international bridge was built across the rapids near the head. The piers in the rapids cut off an area of section of about 1,133 square feet. During the building of the bridge and subsequently, fills have been made near the ends of the bridge, causing a further obstruction estimated at about 1,139 square feet, including three of the small streams above mentioned, and making a total estimated area of section obstructed by the bridge of about 2,272 square feet.

The building, in 1889, of the canal subsequently purchased by the Lake Superior Power Company on the Canadian side, obstructed the fourth of the small streams mentioned above, estimated to have had an area of 1,603 square feet. Subsequently, this company, in connection with the Michigan Lake Superior Power Company, constructed remedial works across spans 9 and 10 of the bridge, span 10 being completely closed and span 9 being closed by stoney gates, which may be opened if necessary. The cross sectional area of span 10 so obstructed was about 724 square feet, and of span 9, 1,649 square feet, giving a total cross section of obstruction of 2,373 square feet for remedial works, or 3,976 square feet, if we include the small stream mentioned above.

The dyke built by the Chandler-Dunbar Water Power Company in 1892 closed the area under the first two spans of the bridge with a total water cross section of about 1,915 square feet.

The total area thus obstructed by all works amounts to 8,163 square feet, or more than one-half of the original cross section. The total area of cross section obstructed previous to the construction of the remedial works was 5,790 square feet.

The first effect of these various obstructions was to reduce the discharge of the river, although the flow through the channels not obstructed was somewhat increased. If no diversion were made, the discharge over the rapids being diminished, the mean water level would eventually rise to such a height as to give a discharge through the restricted cross section equal to that which would have taken place through the original cross section at the lower level. The elevation of the water surface would then fluctuate about this new higher mean level much the same as it did before about the lower mean level. The decrease in discharge, due to the obstructions mentioned above other than the remedial works, may be roughly estimated as follows for stage 601·7 feet:—

	Sec. Ft.
Flow intercepted by international bridge piers and fills	7,000
Chandler-Dunbar Company	7,500
Works of Lake Superior Power Company	4,500
Total	19,000

Since to determine the discharge of the river by observations from the international bridge, the section upon which most of the observations for discharge have been made, involves estimating the amount of water used by the locks and the several power companies, in order to arrive at the total discharge, the results of the discharge measurements are not always accordant. These observations for discharge have not extended over as wide a range of level as could be desired to give a good determination of the rate of change in discharge for change in stage. From a consideration of the published results, however, it appears that previous to the placing of the remedial works at spans 9 and 10 of the bridge, that portion of the discharge of the river passing the rapids alone was 66,500 second feet, at elevation 601·7 feet, and 80,400 second feet, at elevation 602·7 feet. If these discharges are correct, a rise in the water surface of one foot corresponds to an increase discharge of 13,900 second feet and the effect of placing obstructions cutting off 19,000 second feet would therefore be to eventually raise the mean lake level approximately 1·4 feet.

Only a portion, perhaps not more than half, of this obstruction, has actually been effective for the reason that it takes place slowly, and that the obstruction has not been complete since the channels have been replaced by the power canals, through which the water is allowed to pass.

As the result of observations of discharge made in 1899 and 1902 by the officers of the United States' Lake Survey, equations were determined representing the flow in the rapids, first: in spans 3 to 10, inclusive, or previous to the construction of the remedial works, above spans 9 and 10 on the Canadian side of the river, and second: in spans 3 to 8, inclusive, or after the remedial works were in place. From these equations, it appears that previous to the placing of the remedial works, the discharge at 601·7 feet was 66,485 cubic feet per second, and that with the remedial works in place, the discharge at this stage is 56,880 cubic feet per second, giving a diminished discharge, due to the placing of the remedial works of 9,605 cubic feet per second at this stage.

The total flow stopped by the obstructions placed by the various companies may then be summarized as follows for stage 601·7 feet:—

	Sec. Ft.
Bridge	7,000
Chandler-Dunbar Water-Power Company	7,500
Lake Superior and Michigan Lake Superior Company	14,100
Total	28,600

The present uses of water are estimated to be as follows:—

	Sec. Ft.
Government canals	600
Chandler-Dunbar Water-Power Company	1,400
Lake Superior and Michigan Lake Superior Power Company	15,000
Total	17,500

Previous to the placing of the remedial works of the Lake Superior Power Companies, above spans 9 and 10 of the international bridge, the discharge of the river at elevation 601·2 was probably about 61,000 second feet. Although the discharge may have fallen below this figure for a few months in years of low water, it may be taken as the ordinary low water discharge. Of this amount not less than 4,000 second feet should be reserved for the use of locks and the passage of logs. The Michigan Lake Superior Power Company has a canal designed to take a maximum of 31,200 second feet, the Chandler-Dunbar Water-Power Company has works under construction designed to use 4,000 second feet, and contemplates still further development. The Lake Superior Power Company's present works are sufficient to use at least 9,000 second feet, and further development is contemplated, presumably to the extent of using one-half the surplus waters of the river.

It is apparent, therefore, that the actual present use of water for power purposes is nearly equal to the amount of flow obstructed by the works of all the power development companies considered as a unit, and it is clear that the amount of water required for the proposed additions to present power developments is so great as to call for complete control of such extensions by an international commission.

At present the duty of maintaining the water level above the rapids rests upon the Michigan Lake Superior Power Company; the Act of Congress approved June 13, 1902, authorizing this company to divert water from St. Marys river, with the consent of the Secretary of War, and the Chief Engineer, specially provides that the level of Lake Superior shall be maintained at the expense, if need be, of the works of this company. With the knowledge that plans for enlarging the work of the power companies were projected, Congress, in the same Act, provided for an investigation of the conditions with a view to an agreement looking to international control and regulation. The commission has used the rules and regulations under which the Michigan Lake Superior Power Company was permitted by the Secretary of War of the United States, to divert the waters of the St. Marys river, as a basis for the new rules now recommended, adapting them to the wider application now necessary.

RECOMMENDATIONS.

The commission would respectfully recommend:

1. That no permits shall be granted for the use of the waters of the St. Marys river, or for the erection of structures in, under or over, or the occupation in any manner of the said waters until plans have been submitted to the commission for its investigation and recommendation; and the use of the waters under such permits shall not be allowed except upon compliance with the rules hereinafter recommended.

2. The commission further recommends that no grants, permits or concessions should be made, which directly or by operation of law, may, in any manner affect the right of the United States or of Canada, to control the bed of the St. Marys river, below high water mark, and especially that none should be made

which, legally or equitably, may be the means of adding to the expense of acquiring lands or rights for the purpose of making improvements in aid of navigation, or which may give an equitable right to compensation in case of the removal of structures in said river.

3. That steps shall be taken to increase the lockage facilities at Sault Ste. Marie without unnecessary delay.

4. That the governments of the United States and Canada reserve all water necessary for navigation purposes, at present or in the future, and the surplus shall be divided equally between the two countries for power purposes.

5. As the commission regards the interests of the United States and Canada in the preservation of the lake levels, and in the improvement of the channels and the conservation of the water supply for purposes of navigation as identical and as incapable of efficient protection without joint and harmonious action on the part of the two governments, it recommends that the rules hereinafter set forth be adopted, and that a joint commission be created to supervise their enforcement, or that such powers be vested in the existing International Waterdays Commission, subject to such restrictions and reservations as may be deemed advisable.

The commission has adopted unanimously the following resolution:—

Resolved, That this commission recommends to the Secretary of War of the United States, and the Minister of Public Works of Canada, the following rules to govern the use of water at the Sault Ste. Marie:

1. No person shall place any structure in, over or under the St. Marys river, nor shall any person place any obstruction in said river, or make any excavation in the bed thereof, or divert water therefrom, until plans for the work shall have been submitted to an International Waterways Commission nor until consent shall have been given by the Secretary of War of the United States, and the Minister of Public Works of Canada. All work must be done in accordance with plans approved by such commission, and subject to its supervision and inspection; and no water shall be used or diverted until the completed work shall have been approved by the commission.

2. Persons now using or diverting the waters of St. Marys river for power purposes shall forthwith submit complete plans of all their works existing and proposed, and until such plans have been approved by the commission, they shall not use or divert the waters of said river in excess of the amount now actually used or diverted by them.

3. Plans for work contemplating the use or diversion of water, must include such remedial and controlling works as may be necessary to maintain levels. Such works must provide for (1) compensation equal to the amount of water to be used or diverted, (2), complete stoppage of flow through canals and works, (3), passage of the amount of water naturally flowing through the section occupied by the remedial works, (4), passage of logs over the rapids.

4. The level of St. Marys river above the rapids, shall be maintained between the elevations 601·7 and 603·2 feet above mean tide at New York, according to the system of levels established by the United States government in 1903, and defined by a bench mark on the coping of the Weitzel lock at Sault Ste. Marie, Michigan, the elevation of which is 606,069. The approval of plans of works by the commission, and the consent of the Secretary of War and Minister of Public Works to construct works or to use or divert water, shall in no way relieve the owners and persons operating such works from the duty of maintaining said level.

5. Nothing herein contained shall be held to affect any existing riparian or other rights, or the existing remedies therefor, or any action at law or in equity now pending. All remedies herein provided shall be cumulative and shall be without prejudice to any other remedies for failure of persons operating under permits to maintain the levels for navigation purposes. Nothing herein

contained shall be held to affect the exercise of the right of any executive officer of either the United States or Canada, acting under the laws of his respective country, to prevent the placing, or to cause the removal of any obstructions in St. Marys river, or to otherwise preserve or restore the navigability of any part thereof

6. Persons using or diverting the waters of St. Marys river shall operate under the following regulations:—

(*a*) The general superintendent of St. Marys Fall canal, under the orders of the engineer officer in charge on the American side, and a resident officer appointed by the Canadian government on the Canadian side, shall form a board whose duty it shall be to see that these regulations, and any others that may hereafter be made by proper authority, are duly obeyed. The officers of this board and their deputies shall have access to all the power works at any time, and all said power works, which term includes canals, escape valves at the power houses, head gates and remedial works, shall be operated in accordance with the orders of the said board, and said board shall have power to assume entire control of said works, or any of them, whenever it considers such action necessary in the interests of navigation.

(*b*) Should the monthly mean level fall below 601·7 feet for any calendar month, the flow through the power works shall be reduced to such an extent as to restore the monthly mean level to 601·7. Should the monthly mean level remain below 601·7 feet for six consecutive months, all flow through the power works shall be stopped until the monthly mean level shall again be above 601·7 feet. Should the monthly mean level fall below 601·2 feet, all flow shall likewise be stopped until the monthly mean level shall again be above 601·2 feet.

(*c*) Should the monthly mean level rise above 603·2 feet, the flow through the power canals and remedial works shall be increased to their maximum capacity, and shall so continue until the monthly mean level shall be less than 603·2 feet.

(*d*) Should the power canals, remedial or controlling works be found not to be of the capacity to produce the regulation required, the persons using the water shall alter their works at their own expense as soon as possible, so as to allow more to flow, in a manner approved by an international commission.

(*e*) Should currents detrimental to navigation be developed by the operation of any power works, the persons operating such works shall alter them or construct such other works as an international commission may consider necessary to remedy the evil, all in a manner to be approved by said commission.

(*f*) The board mentioned in regulation (*a*), shall have power to determine whether the conditions mentioned in any of these regulations have arisen to call for the application of said regulations, and its determination shall be final; and said board shall have power to apply to any power works such special regulations as they may deem necessary in the interests of navigation.

(*g*) If remedial works can be used for the passage of logs or rafts, the gates must be operated at the expense of the persons owning or operating the works whenever needed.

7. Wherever powers of officers are mentioned in these rules, it is understood that the governments of the United States and Canada reserve the right to vest such powers in, and confer others upon, other officers or the international commission.

8. It is further understood that the governments of the United States and Canada reserve the right to amend, add to, or abolish these rules or any of them by joint action and that they may vest the power so to do in the international commission.

9. In the event of any person subject to these regulations refusing or neglecting to obey, abide by, or conform to any ruling, direction or order of the com-

mission, or of the board mentioned in regulation (*a*), such commission or board may, through their officers, servants, or agents, at once shut off the supply of water to such person, or to take such steps to compel compliance with such ruling, direction or order as the commission or said board may deem proper.

10. Persons owning or operating power canals or works shall not be entitled to damage or compensation from the governments of the United States or Canada in any case whatsoever, for any act or acts done by them or either of them, or by their officers or agents at any time, in executing or enforcing these rules, or in exercising the right to control or suspend the flow of water through canals or remedial works, or both, or in revoking or annulling any permits of grants which may have been or shall hereafter be issued or made to such persons.

11. For the purpose of construing these rules, the word 'person' or 'persons', shall be taken as including natural persons, corporations, associations and partnerships, whenever they are used, but shall not include the government of the United States or that of Canada.

(Sgd.)	GEORGE C. GIBBONS, *Chairman, Can. Sec.*	(Sgd.)	O. H. ERNST, *Chairman, Amer. Sec.*
(Sgd.)	W. F. KING, *Commissioner.*	(Sgd.)	GEORGE CLINTON, *Commissioner.*
(Sgd.)	LOUIS COSTE, *Commissioner.*	(Sgd.)	GEO. Y. WISNER, *Commissioner.*
(Sgd.)	THOMAS COTE, *Secretary, Can. Sec.*	(Sgd.)	L. C. SABIN, *Secretary, Amer. Sec.*

JOINT REPORT ON THE APPLICATION OF THE INTERNATIONAL DEVELOPMENT COMPANY FOR PERMISSION TO CONSTRUCT REGULATING WORKS ON THE RICHELIEU RIVER.

BUFFALO, N.Y., November 15, 1906.

To the Honourable the Minister of Public Works of Canada, and to the Honourable the Secretary of War of the United States.

The International Waterways Commission has the honour to submit the following report on the application of the International Development Company for permission to construct regulating works in the Richelieu river, referred to it by endorsement of the Honourable Secretary of War of the United States, dated November 6, 1906.

The applicants are the assignees of a charter granted by special Act of Parliament of the Dominion of Canada to the Lake Champlain and St. Lawrence Ship Canal Company (Statutes of Canada, 1898, chapter 107), which has been extended by two enactments, the last of which, in the year 1905 (Statutes of Canada, chapter 116), extends the time for commencing the works of the company to the year 1908.

No plans of the proposed works have been submitted, and it is understood that none have been made. The works are to be located in Canadian territory, and can be built only with the authority and approval of the Canadian government. It is supposed that proper plans will in due season be submitted to that government. The works will, however, affect the levels of Lake Champlain, and may thus seriously affect the navigation or property interests of American

citizens on that lake. The company submits a preliminary statement showing in general what is proposed to be accomplished, and the supposed effect upon Lake Champlain, with a view to ascertain what the attitude of the United States government will be towards the enterprise, and it is that which has been referred to us.

It is ascertained from this statement that for navigation and power purposes a continuous flow of not less than 9,000 cubic feet per second is desired in the Richelieu river. The average annual flow is greater than this, being about 12,700 cubic feet per second. The low water discharge is about 3,800 cubic feet per second, and there are periods, sometimes extending over six or eight months, when the discharge is continuously less than 9,000. It is proposed to store up in Lake Champlain during the high water season enough of the surplus water to supply the deficiency during the low water season. For this purpose regulating works are to be constructed in the Richelieu river by which the level of Lake Champlain will be maintained at a minimum of 97 feet above tide at New York; and it is stated that these works will not under any circumstances raise the high water level of Lake Champlain above 'the present high water mark', given as 101·5. Thus it is proposed to give the lake a range of 4·5 feet.

On page 324 of the report of the Board of Engineers upon deep waterways between the Great Lakes and the Atlantic tide waters is a tabular statement of the monthly mean discharge of Lake Champlain for the years 1875 to 1898, inclusive. An examination of this table shows that the period which gave the lowest discharge extended from September, 1882, to March, 1883; that which gave the next lowest extended from September, 1876, to March, 1877; that which gave the third lowest extended from September, 1883, to February, 1884; and that which gave the fourth lowest extended from August, 1894, to March, 1895. During these periods the amount flowing was less than 9,000 cubic feet per second, and in order to maintain that flow it would have been necessary to draw, from water previously stored for the purpose, the difference between 9,000 cubic feet and the amount which actually flowed.

	Cubic feet.
The deficiencies for the first period were	58,803,840,000
Those for the second period were	55,572,480,000
Those for the third period were	51,278,400,000
Those for the fourth period were	46,759,680,000

The area of Lake Champlain is 436·7 square miles, or 12,174,497,280 square feet. The depth required to store the deficiency during the first of the above periods is 4·81 feet; that for the second period is 4·56 feet; that for the third period it is 4·21 feet; and for the fourth period it is 3·84 feet. Adding 1·25 for evaporation in eight months, those depths become 6·06, 5·81, 5·46 and 5·09 respectively. The range proposed, 4·5 feet, will therefore not be sufficient to provide 9,000 cubic feet per second throughout the low water season in very dry years.

A range much greater cannot be admitted without inflicting damage either upon the riparian owners or the navigation interests of Lake Champlain. In determining what is a proper high water and what a proper low water stage in this connection, it is not fair to take the extremes which the lake may have reached at long intervals in its history. A high water stage reached once in twenty years, for example, might inflict damage to property without destroying it, while if reached every year it might cause complete destruction; likewise the obstruction to navigation caused by an extreme low water stage would be greatly multiplied if repeated every year.

The table on page 323 of the Report on Deep Waterways quoted above, gives the monthly mean stages of Lake Champlain from 1875 to 1898. The

highest stage there recorded is 100·13 for the month of April, 1896. Upon only two other occasions did the stage reach 100. To raise the level above 100 regularly every year would be to inflict an injury upon the riparian proprietors.

The mean elevation of the lake for the entire period was 96·10. The lowest stage reached was 93·65. During seven years it did not fall below 95. To allow the lake to be drained below 95 every year would be to inflict injury upon the navigation interests.

The limits between which the lake should be regulated are, therefore, 100 as a maximum and 95 as a minimum, notwithstanding that the reserve of water will not in very dry years be sufficient to supply 9,000 cubic feet per second.

As Lake Champlain is wholly within the territory of the United States, and the proposed works are wholly within Canadian territory, the international questions raised are of some moment. It is, in our opinion, not desirable that either nation should obstruct the natural flow of streams crossing the international boundary to the injury of public or private rights in the other. It is manifest, therefore, that the applicants should furnish conclusive evidence that private rights in the States of New York and Vermont adjoining Lake Champlain will not be injuriously affected by the alteration of the lake level as proposed, and that as the Secretary of War of the United States has control of the interests of navigation on Lake Champlain, the said work should not be undertaken without his permission and should be operated under such regulations as he may direct with a view to the maintainance of the level of the said lake as the interests of navigation thereon may require. It would be possible to plan works adapted to the conditions, and in our opinion such works should be permitted, provided they do not interfere with private interests in the United States and meet with the approval of the Secretary of War as suggested. We respectfully submit that in any treaty to be had between the two nations in relation to the use of the international waters, the principles above suggested should have consideration. We would further suggest that the applicants' Canadian Act of incorporation should be amended so as to provide that the maintenance of the works sought to be erected shall be conditional at all times upon compliance with all regulations imposed by the Secretary of War of the United States of America, from time to time for the preservation of the levels of Lake Champlain.

All of which is respectfully submitted.

GEO. C. GIBBONS,
Chairman, Canadian Section.

O. H. ERNST,
Brig.-General, U.S.A., Retired.
Chairman, American Section.

W. F. KING,
Commissioner.

GEORGE CLINTON,
Commissioner.

LOUIS COSTE,
Commissioner.

E. E. HASKELL,
Commissioner.

Attest,

THOMAS COTE,
Secretary, Canadian Section.

Attest,

W. EDWARD WILSON,
Secretary, American Section

JOINT REPORT ON THE APPLICATION OF THE MINNESOTA CANAL AND POWER COMPANY, OF DULUTH, MINNESOTA, FOR PERMISSION TO DIVERT CERTAIN WATERS IN THE STATE OF MINNESOTA FROM THE BOUNDARY WATERS BETWEEN THE UNITED STATES AND CANADA, 1906.

BUFFALO, N.Y., November 15, 1906.

To the Honourable the Minister of Public Works of Canada, and to the Honourable the Secretary of War of the United States.

The International Waterways Commission would respectfully report that it has investigated as fully as existing data would permit the matters involved in the applications of the Minnesota Canal and Power Company, of Duluth, Minnesota, for the approval of its plans and structures to divert water from the Birch lake drainage basin in St. Louis and Lake counties, Minnesota, and for the use of certain public lands of the United States in said counties, and that it has heard the parties interested in said applications and those opposed. The physical data, outside of those furnished by the applicant, are few and not sufficient to show all the conditions existing. The applicant, however, has furnished maps and data which are not seriously contested by those opposing the applications, and they are considered sufficient to warrant the conclusions at which the commission has arrived, as set forth in this report.

The application to the Secretary of War of the United States is for the approval of certain plans for structures which will impound the waters of the Birch lake drainage basin, and divert them from that basin to Lake Superior, and for authorization to erect such structures and divert the waters

The application to the Department of the Interior is for permission to use certain public lands, by flowage and otherwise, for the purpose of creating electrical power at Duluth, on Lake Superior. The Minnesota Canal and Power Company propose to divert water from the Birch lake drainage basin, which is naturally tributary to the Rainy river, Lake of the Woods, Winnipeg river and lake, and finally to Hudson bay. The quantity of water to be so diverted is mentioned in some of the documents before the commission as 600 cubic feet per second, but the company does not propose to limit itself to that amount if it be found, after the completion of its works as now planned, that a greater quantity can be obtained without injury to navigation interests. With 600 cubic feet per second about 30,000 electrical horse-power can be generated for use in Duluth and the mining regions of Minnesota.

The subject matter under consideration was called to the attention of the Canadian section of this commission by the Honourable the Secretary of State for Canada, in a letter dated January 6, 1905, in which, among other things, in stating the subjects that might come before the commission for its consideration, he mentions 'the proposed diversion southward by the Minnesota Canal and Power Company, of Duluth, of certain waters in the state of Minnesota, that now flow north into the Rainy river and the Lake of the Woods.' The same matter was called to the attention of the American section by a letter from the Minnesota Canal and Power Company, dated March 10, 1905, addressed to the chairman, in which the company referred to the application of the Power Company pending in the Interior Department, stating that it was advised that one of the subjects which would come before the commission for consideration is the proposed diversion southward of certain waters in the state of Minnesota that now flow north into the Rainy river and the Lake of the Woods, and requesting that the matter be brought before the commission at the earliest practicable moment.

At a meeting of the commission, held June 15, 1905, this matter was laid over for the reason that other and more pressing matters required the attention of the commission, and for further reason that the jurisdiction of the commission over any waters except those in, or tributary to, the Great Lakes and the St. Lawrence river had been placed in doubt by the construction given by the government of the United States to the Act of Congress under which the commission was organized. The subject-matter having now been referred to the commission by the Honourable the Secretary of War of the United States, and the Honourable the Secretary of State for Canada, we regard our jurisdiction as fully established.

The Minnesota Canal and Power Company is a corporation organized under the laws of the state of Minnesota, with power to erect the works for the construction of which authorization is sought from the War Department of the United States, and with certain powers of eminent domain. It has heretofore brought proceedings in the District Courts of Minnesota for the purposes of putting into exercise the right of eminent domain and of condemning property and rights of persons who may be affected by the carrying out of its plans. The result of these proceedings has been an appeal to the Supreme Court of Minnesota, which has decided that the waters which would be affected by the carrying out of the power company's plans are public navigable waters, and that the statutes under which the company is organized do not, as an incident to the construction of a canal and the creating of a water-power, authorize a corporation to withdraw and divert waters from public navigable lakes and streams to such an extent as to interfere with present or future navigation, and by means of canals carry it over a divide and discharge it into a different drainage area, thus permanently withdrawing it from its natural course. This decision resulted in holding that the proceedings taken by the company to condemn property and rights of individuals must be dismissed.

The court says that 'In view of the presumption in favour of the rights of the individual, the state and federal prohibition against the obstruction of navigable waters, the rule that the rights of the state in such waters are sovereign and not proprietary, that they are held by the public as highways and cannot be alienable, the possible effect upon the rights of riparian proprietors in the province of Ontario, the fact that the doctrine of the appropriation of waters, adopted in some of the western states, does not prevail in Minnesota, and is not recognized by the conventional law of nations, the treaty relations between the United States and Great Britain with reference to the boundary waters between the United States and Canada, and that the taking of the waters would interfere with streams and lakes which are already devoted to public uses, which can only be done under express statutory authority,' it is constrained to hold that the appellant is not authorized to condemn the interests sought to be condemned. The applicant, assuming that the decision of the Supreme Court, adverse to it would be adhered to only upon the ground that its petition included private as well as public uses, has filed another petition making the purposes for which condemnation will be sought wholly public and has begun new condemnation proceedings.

Objections and protests have been filed with the commission on behalf of various interests opposed to the granting of the Canal and Power Company's application. These objections may be divided into two classes: first: objections made by parties claiming that they have interests and property rights in the state of Minnesota which will be affected by the carrying out of the Canal and Power Company's plans; and second: objections made by parties having interests in the boundary waters in the state of Minnesota and in Canada, which it is claimed will be affected by the proposed diversion of the waters of the Birch lake drainage area.

The first class of objectors includes Frederick B. Spelman, who claims to be the owner in fee of valuable water rights on Birch river; the Northeastern Minnesota Power Company, a corporation organized under the laws of the state of Minnesota for the purpose of generating electricity by water-power, and distributing and selling the same, which claims that it is the owner of certain real estate in Lake County, Minnesota, bordering on Kawishiwi falls; the St. Croix Lumber Company, and the Fall Lake Boom Company, corporations organized under the laws of the state of Minnesota, which, acting together, are engaged in the manufacture of lumber in the state of Minnesota, and using, for the purpose of bringing logs to the mills of the lumber company, waters which would be affected by the diversion contemplated by the Canal and Power Company, and which companies also have certain property interests in Minnesota; and Lazarus Silverman, representing the Enterprise Iron and Land Company, which has valuable land and water interest in Minnesota. It is understood that the interests of the last named company are owned or controlled by the Northeastern Minnesota Power Company. Others having interests in the United States are the Hope Land Company, the Higgins Land Company and the Higgins Wild Cat Company, who object on the ground that the reservoir proposed will flood their lands, and the Duluth and Iron Range Railroad Company, which protests against the projected work as being 'an improper and unwarranted use of the international waters.'

The property, rights and interests of all these parties will be injuriously affected, to a greater or less extent, in case the Minnesota Canal and Power Company is permitted to impound the waters of the Birch lake drainage basin and divert them to Lake Superior from the streams flowing into the boundary waters. The commission, however, is of the opinion that the rights and interests of these parties can be properly protected under the laws of the state of Minnesota. We, therefore, conclude that their objections do not present any international questions, and such questions alone the commission considers as having been referred to it.

The second class of objectors include the corporation of the town of Fort Frances, in the province of Ontario, which claims to have valuable navigation advantages upon Rainy river, long recognized as an international waterway; the Koochiching Company, a corporation organized under the laws of the state of Iowa, the owner in fee simple of a section of land bordering on Rainy river at Koochiching falls, opposite Fort Frances; the Rainy River Improvement Company, a corporation organized under the laws of the state of Minnesota, for the purpose of improving the navigation of the boundary waters by means of dams and canals to be constructed at Koochiching falls and elsewhere, for the development of water-power at the Koochiching dam, and for the transportation of logs; and Edward W. Backus, of Minneapolis, who has entered into a contract with the government of Ontario, by which he has agreed to construct a dam across the Rainy river and develop power at the Koochiching falls, which agreement is now understood to be assigned to the Ontario and Minnesota Power Company, a corporation organized under the laws of Canada. It is understood that the Koochiching Company, the Rainy River Improvement Company, Edward W. Backus and the Ontario and Minnesota Power Company are associated and are acting in concert. The Rainy River Navigation Company and the city of Winnipeg also object to the proposed diversion.

These interests strenuously object to the carrying out of the plans of the Minnesota Canal and Power Company, claiming that diminution of water by reason of the proposed diversion in the streams which they propose to utilize will greatly injure their navigation interests and their ability to produce electric power.

In addition to these objections of individuals, the Canadian government, acting upon a memorial of the municipal corporation of Fort Frances, addressed

to the Canadian Minister of Marine and Fisheries, brought the proposed diversion to the attention of the British Ambassador at Washington for his information and such action as might be possible in the premises. A copy of this memorial is hercto attached, marked 'A'. Upon receipt of the communication from the Canadian government, the British Ambassador presented the matter to the Secretary of State of the United States, on January 3, 1905, requesting that the proposed diversion be not carried out pending the meeting of this commission.

At a hearing before the commission, held at Buffalo on June 26, 1906, Col. Anderson, chief engineer of the Department of Marine and Fisheries of Canada, and Mr. J. G. Sing, engineer in charge of the Rainy River district of the Department of Public Works of Canada, appeared and opposed the proposed diversion on the ground that it would be detrimental to Canadian interests and especially to navigation upon the boundary waters. At a meeting of the commission, held in Toronto on July 24, 1906, written objections were presented as follows, viz: A resolution of the municipal council of the town of Kenora, Canada, a copy of which is hereto annexed, marked 'B', a letter from Mr. George A. Graham, manager of the Rainy River Navigation Company, a copy of which is hereto annexed, marked 'C', a resolution of the Kenora Board of Trade, a copy of which is hereto annexed, marked 'D', and a written statement by Mr. Sing, hereto annexed, marked 'E'.

At a meeting of the commission, held at the city of Chicago, Illinois, on the 17th day of October, 1906, H. N. Ruttan, city engineer of the city of Winnipeg, Canada, appeared before the commission in opposition to the application of the Minnesota Canal and Power Company. After stating that the probable head available for power purposes between Rainy lake and Lake Winnipeg, on the Winnipeg river, approximates three hundred feet, that the discharge of Winnipeg river at Point du Bois falls, in the province of Manitoba, was nineteen thousand cubic feet per second in March, 1906, and that the discharge at extreme low water might reach a maximum of seventeen thousand cubic feet per second, that works had been completed and were in course of construction between Rainy lake and Lake Winnipeg, aggregating approximately one hundred and fifty thousand horse-power, involving an expenditure of between fifteen and twenty millions of dollars, and that many additional powers are projected, some of which will no doubt be constructed, that the city of Winnipeg has a population of one hundred thousand, which is rapidly increasing, and has voted to construct a water-power at Point du Bois, at a cost estimated at three and one-quarter millions of dollars for preliminary development, Mr. Ruttan, on behalf of the city of Winnipeg, objected to the diversion of water which naturally belongs to the Winnipeg watershed.

The action of the British Ambassador, at the request of the Canadian government, together with the fact that the rights and interests of Canadian citizens will be affected by the carrying out of the plans of the Minnesota Canal and Power Company, and the fact that navigation of boundary waters will be to some extent injured if such plans are put in operation, presents international questions, which, in the opinion of this commission, will be involved in many other instances of boundary streams between the two countries and require the most careful consideration. In order that there may be no question as to the exact intent of the commission in giving its conclusions, it is deemed best to state with as much exactitude as possible the existing conditions which give rise to the questions to be disposed of.

The commission finds the physical conditions of the locality to be as follows: The Birch Lake drainage basin is situated in the counties of St. Louis and Lake, in the state of Minnesota, the border of the basin being only about fourteen miles from Lake Superior. This drainage basin contains a chain of small lakes, the largest of these known as Birch lake, lying near the western border

of the basin. A portion of the drainage of this basin flows westerly through the North Kawishiwi river and Farm lake to Garden lake, with a fall of about fifty-six feet in the distance of nine miles; another portion flows southwesterly through the south Kawishiwi into Birch lake, and thence northerly through Birch river and White Iron lake to Garden lake, the distance traversed by the waters along this route being about twenty-four miles. Passing Kawishiwi falls, the waters, continually increasing in volume, flow through Fall lake over the Pipestone falls to Basswood lake, lying on the international boundary between the United States and Canada; the waters thence flow in a general northwesterly direction through Crooked and Iron lakes, Lac la Croix, Namakan river and lake, to the Rainy lake, and thence through Rainy river to the Lake of the Woods. From Basswood lake to the Lake of the Woods the waters flow along the international boundary line with the exception of about twenty miles where they traverse the Namakan river, entirely in Canadian territory.

Within two miles of the western end of Birch lake, and separated from it by a low divide, rises the Embarrass river, its waters flowing southwesterly through Sabin, Embarrass and Esquagamau lakes into the St. Louis river, and thence into St. Louis bay and Lake Superior. The St. Louis bay and river form a portion of a boundary between Minnesota and Wisconsin and are navigable from Lake Superior to Fond du Lac, Minnesota. From Fond du Lac to Cloquet the St. Louis river is navigable, there being a fall of approximately six hundred feet in a distance of fourteen miles; above the latter point it is used to float logs, about twenty-five million feet, it is said, being transported annually.

The natural waterway from Birch lake to Rainy lake may be described as a series of pools of greater or less extent connected by short and shallow channels containing rapids or falls. The pools or lakes are capable of floating logs and are in general navigable by small steamboats; but the connecting channels are, in their natural condition, not navigable save by canoes or small boats and in places are wholly unnavigable, some of them being even incapable of floating logs, except at times of high water. The channels connecting Birch lake with the lakes directly north are of this character and a dam has been erected at the outlet of Birch lake for the purpose of raising the water and floating logs over the rapids by means of the greater flow made available by opening gates; and at the outlet of Garden lake a roll dam has been built to serve a similar purpose.

Navigation upon Birch lake is confined to canoes and rafts of logs which are towed by a small tug called a log puller. This tug was built upon the lake and under present natural conditions is confined to its waters. Similar conditions prevail on White Iron and Garden lakes, the pools next below or north of Birch lake, a steam log puller being operated on each. About twenty million feet of logs are said to be transported annually from Birch lake and vicinity to a saw-mill on Fall lake.

Between Birch lake and Rainy lake the only through navigation is by canoes and it is said that there are no less than eighteen places at which portages are required by reason of the waterfalls and rapids.

Basswood and Crooked lakes, Lac la Croix and Namakan lake are all navigable and it is understood that they are not only used for the floating of logs but that one or more small tugs or logs pullers are in use upon each of them, although through navigation by boats is not possible. There have been at least two small steamboats operating on Basswood lake having a gross tonnage of three and ten tons respectively.

Rainy lake is a navigable waterway and several steamboats of small tonnage are operating upon it. There are two points in this lake restricting the navigable depth. One of these is known as the 'Brulé Narrows,' about midway of its length, and the other is at Pither's Point, at the outlet of the lake and just above Koochiching falls. The depth at these points in ordinary low water

is about seven feet and it is understood there have been years when the larger boats were laid up on account of low water. The allied interests represented by the Rainy River Improvement Company on the American side and the Ontario and Minnesota Power Company on the Canadian side are engaged in building dams at Fort Frances above Koochiching falls for the purpose of improving the water-power, and thereby incidentally improving the navigability of Rainy lake by raising the elevation of its water surface.

There are two, and possibly more, steamboats operating on Rainy river, and making regular trips between Fort Frances at the Koochiching falls and Rat Portage on the Lake of the Woods, and touching at way ports.

The only improvement made by the United States government on any of these waterways is at the harbour of Warroad, Minnesota, which has been improved to a depth of seven feet below the stage of water at the time of making the survey. The elevation of the Lake of the Woods, and consequently the depth of water in the harbour, is controlled by the operation of the Keewatin dam at Rat Portage, which is operated under the direction of the Canadian government. The Annual Report of the Chief of Engineers, U.S.A., 1904, gives the following statistics regarding the commerce of the town of Warroad:

'The town of Warroad, now four years old, has a population of 700, and the adjacent country is rapidly filling up with settlers. The imports of Warroad increased from 254 tons in 1900 to 2,754 tons in 1904. During the same period the exports increased from 1,215 tons to 9,929 tons.'

In the report of 1905, the following statement is made:

'The town of Warroad, now five years old, has a population of about 1,000, and the adjacent country is rapidly filling up with settlers.

'Up to this time Warroad Harbour has had no regular lake traffic, the condition of the entrance to the harbour not having been such as to permit it.

'On the Lake of the Woods there are at present 25 or more registered Canadian boats, ranging from 30 to 486 tons burden, some of which occasionally visit Warroad Harbour when conditions are favourable.

'The United States boats connected with Warroad Harbour are the propellers *Na-ma-puk* and *Knute Nelson*, the former about 36 feet long and the latter about 80 feet.'

The Canadian government has made slight improvements above the Lake of the Woods and an agreement has been made between the Commissioner of Crown Lands for the province of Ontario and E. W. Backus, who subsequently transferred his rights to the Ontario and Minnesota Power Company, whereby in return for certain water-power privileges the latter is required to construct a dam at Koochiching falls to be subject to the control of the government, making it possible to maintain the water level in Rainy lake at or above the present extreme high water stage.

The country traversed by the waterway leading from Birch lake to Rainy lake is in general rough and unimproved. The timber consists of white and Norway pine, spruce and less valuable woods, typical of Lake Superior forests. The pine is being rapidly cleared from some of the larger tracts. The Vermilion and Mesabi iron districts cross the territory between Birch lake and the boundary line, and the soil is shallow and not well suited to agriculture.

The population, in 1900, of the townships bordering the waterway from Birch lake to and including Basswood lake, did not exceed 4,000, the town of Ely having a population of 3,717. This sparse population depends largely upon the mining and timber industries of the locality. The population of the townships on the American side bordering the Basswood lake to and including the Lake of the Woods, and covering about 200 miles of shore line, was only about 600 according to the census of 1900. The country bordering the Lake of the Woods on the Canadian side is fairly well settled. On the American side it is wilderness

composed largley of Indian reservations, portions of which have been thrown open to settlement. The vicinity of Warroad has been recently so opened.

At several places along the waterway from Birch lake to Rainy lake, development of water-power is possible, but at most of them it is not commercially feasible at present, for the following reasons: A considerable fall is not usually concentrated at one point, but is distributed over rapids; the flow is not uniform, but is very small during the dry season, and, unless the waters of the flood season are impounded, the extent of the possible continuous development is restricted by the low water flow; the construction of reservoirs would entail a heavy expenditure in proportion to the possible development; the demand for power in the vicinity is extremely limited.

The Kawishiwi falls may be an exception to this general rule and the development of this power may be commercially practicable in the near future, if not at present. In this case there is a fall of about 65 feet in three-quarters of a mile between Garden lake and Fall lake, and by the construction of a reservoir system similar to that proposed by the applicant, there would be available about 6,000 theoretical horse-power. A market for this power could probably be found at Ely and in the mines in the locality.

Between Birch lake and White Iron lake there is a natural fall of about 28 feet. If the North Kawishiwi outlet of Birch lake were closed by a dam, and an extensive reservoir system constructed similar to that proposed by the applicant, there would be available at this point about 2,500 theoretical horse-power.

Below Kawishiwi falls and between the outlet of Fall lake and Basswood lake there is a fall of about 15 feet in less than three miles. By using 820 cubic feet per second, which is the minimum flow, plus the amount of water to be diverted, there would be available 1,500 theoretical horse-power.

The value of the three water-powers last mentioned, whether present or prospective, would be practicably extinguished by the applicant's proposed work, but, as before stated, the rights of their owners can be properly protected under the laws of Minnesota.

At Koochiching falls in the Rainy river, just below the outlet of Rainy lake, there is a natural fall of about 23 feet in a short distance. The minimum discharge of the river has been estimated at 3,500 cubic feet per second. This volume would give about 7,800 theoretical horse-power without storage, and by raising the water level of Rainy lake five to seven feet by means of dams above Koochiching falls it would be possible to double this development. Even this would permit the utilization of less than half of the average outflow. Unless an extensive reservoir system is constructed, therefore, including the lakes near the headwaters, at least one-half of the waters of the basin tributary to Rainy lake, or more than ten times the quantity of water proposed to be used by the applicant, will serve no useful purpose for power development at this point.

The improvements for which the applicant now asks approval are as follows: To erect a dam at the mouth of Gabbro lake to impound water in the lakes tributary thereto and form what is called the Isabelle reservoir; to erect a dam in the North Kawishiwi river to impound the waters in the lakes and streams tributary to Birch lake naturally flowing westerly into White Iron and Garden lakes; to erect a dam in the South Kawishiwi river, which, in connection with the dam last mentioned, will form the Kawishiwi reservoir; and to erect a dam in Birch river at the outlet of Birch lake to impound its waters and form the Birch Lake reservoir. The company proposes to cut a canal from the west end of Birch lake a distance of about six miles across the divide to the headwaters of the Embarrass river and to erect controlling works at the entrance to this canal to regulate the flow of water from Birch lake into the Embarrass river canal. From a point in the St. Louis river above Cloquet it proposes to dig another canal about twenty-four and one-half miles long to a point in the city of Duluth,

where the bluff is about 600 feet above the water level of Lake Superior, and to lay pipes from the easterly end of this, the St. Louis river canal, to the power-house of the company to be erected on the shores of St. Louis bay. It is proposed to divert at least 600 cubic feet of water per second from the Birch Lake reservoir into the Embarrass canal and river, and thence into the St. Louis river, and to take the same amount from the latter into the St. Louis river canal and convey it by canal and pipes to the turbines located in the company's power-house, thereby developing about 30,000 electrical horse-power; the amount of water diverted and of power created to be increased hereafter if circumstances permit.

The amount of water the company proposes to divert from natural channels leading to Basswood lake, and thence along the international boundary, is estimated to be about 37 per cent of the water tributary to Basswood lake, four per cent of that tributary to Rainy lake, and two and four-tenths per cent of that tributary to the Lake of the Woods.

The data available covering the hydraulic conditions are inadequate for an accurate analysis of the effect of the work proposed by the company, since the distribution of the supply and the discharge of the outlets of the several lakes throughout the year have not been determined. The effect on the navigable depth of Rainy lake and the waterway below that point would be very slight under natural conditions and become still less important by reason of the fact that the elevation of Rainy lake will be controlled by the Koochiching dam, when completed, as the elevation of the Lake of the Woods is now controlled by the Keewatin dam. The company offers no objection to the suggestion to conserve navigation interests by the construction of such remedial works as may be necessary. While the data are insufficient to determine the extent of the remedial works required, they are sufficient to warrant the belief that full compensation is possible.

The minimum discharge from Birch Lake drainage basin is estimated by the engineers of the company to be about 220 cubic feet per second and the average discharge about 975 cubic feet per second. The reservoir system created by the dams proposed by the company will permit of storing a portion of the waters during months of excessive supply for use during the remainder of the year when the natural supply is deficient.

From April to June inclusive the supply to the lakes is greatly in excess of the natural discharge, and in July, August and September the supply in a year of ordinary precipitation is probably in excess of the amount to be withdrawn by the applicant. It would appear, therefore, that the reservoirs might in general be kept full until October first. The reservoirs proposed by the applicant are sufficient to store eight billion, nineteen million cubic feet of water, and it is claimed that this capacity might be doubled by an extension of its works, without interference with other water-sheds draining north. If the proposed smaller capacity reservoirs were full on October first, the applicant could withdraw its own supply entirely from the reservoirs for five months and still permit the natural supply of the lakes during this low water period to flow in the present channel. Under such conditions the usual low water discharge of Birch and North Kawishiwi rivers would be depleted by the amount of water now supplied by the lakes tributary to them; namely, by the natural decrease in stage of those lakes during low water. It would be possible to require the company to maintain at all times a flow in the natural channel equal to the present estimated minimum discharge, without disastrously affecting the applicant's plans.

The lakes could be held at or above the present elevation by a dam properly constructed at the outlet of each, and the future improvement of the stream, in general, by locks and dams, would not be impaired when prospective commerce demands such a step. In order, however, to accommodate the commerce now existing or in prospect between adjoining lakes above Rainy lake, namely, the transportation of logs over rapids and falls, the gates in these dams would have

to be operated with regard to the necessities of commerce rather than to serve the interests of the applicant and should be so operated.

In a report upon this subject addressed to the Chief of Engineers, U. S. Army, by Major Geo. McC. Derby, May 24, 1905, Major Derby enumerated the conditions under which he considered the application should be granted, and the applicant appears to be willing to accept these conditions, which include the following:

'The Minnesota Canal and Power Company should construct and maintain a dam or dams in Lake Namakan, or at some other point or points above Rainy lake, so as to impound and store during periods of high water, when it would otherwise go to waste, an amount of water equal to the entire amount diverted from the watershed of Rainy lake, releasing this water into Rainy lake from time to time as the interests of navigation in Rainy river and above may require, in accordance with regulations to be made by the Secretary of War.'

'The Minnesota Canal and Power Company should construct and maintain such additional dams as may be necessary to maintain Basswood lake and the other lakes between Birch lake and Rainy lake at or above their mean level; and should release from all such dams from time to time such amount of water as may be necessary to sluice logs from one lake to the next, and for other interests of navigation, in accordance with regulations to be made by the Secretary of War.'

It is quite apparent that the interests to be promoted at the city of Duluth, and at the Minnesota mines, by the generation and transmission of electricity, if the diversion be permitted, will be very great, the amount of horse-power which will be available being about 30,000.

The canal which the applicant proposes to construct, and the improvement of the lakes and streams south of the Birch lake drainage area, will furnish additional aids to navigation, particularly for the transportation of logs cut in the forests within that area.

INTERNATIONAL ASPECT OF QUESTIONS INVOLVED.

The proposed diversion, so far as it would affect navigation upon boundary waters, presents a serious objection to the granting of the permit asked.

By the terms of article II. of the treaty of 1842, between the United States and Great Britain, the boundary line from a point in the Neebish channel, where the commissioners appointed under the sixth article of the treaty of Ghent ended their labours, was defined westward to the Rocky mountains. In that article there is added to the description this sentence:

'It being understood that all the water communications and all the usual portages along the line from Lake Superior to the Lake of the Woods, and also Grand Portage, from the shore of Lake Superior to the Pigeon river, as now actually used, shall be free and open to the use of the citizens and subjects of both countries.'

This clause secures to Canada free and unobstructed navigation of the boundary waters from which the proposed diversion is to be made. In the opinion of the commission it secures to Canada, by necessary contruction, the right to navigate those waters in any manner which the natural flow will permit. Any interference with the natural flow which decreases the navigable capacity of Basswood lake, Rainy river, Rainy lake or the Lake of the Woods is a violation of the letter and spirit of the treaty, and the extent of the interference is not important; if the navigable capacity is injuriously affected, Canada has the right to object. Nor does the possibility of restoring and regulating the flow in the boundary waters mentioned, by remedial works, confer any right to lessen the navigable capacity, for such works will have to be constructed in part in the Dominion of Canada and this cannot be done without Canada's consent, nor can the burden of constructing such works be imposed upon her.

The commission is aware that the clause of the treaty of 1842, quoted, has received a different construction from that which we place upon it. It has been said that the phrase 'as now actually used' applied to the use of the waters, and that, as at the time the treaty was entered into those waters were used for canoe navigation only, the treaty secures the right of canoe navigation and nothing more. This construction seems to us erroneous. The language of the clause secures the free and open use of the waters specified and the use of Grand Portage, as it was then 'actually used.' We deem it quite clear upon the face of the treaty that this was the intention of the treaty powers. The clause we are considering is divided into two subjects: one is the free and open use of the water communications and usual portages, and the other is the use of Grand Portage, and the subject matters are separated by the expression 'and also,' which would seem clearly to make the expression 'as now actually used' relate to the Grand Portage, inasmuch as that is introduced by the expression 'and also.' This construction would seem to be supported by the conditions existing at the time the treaty was negotiated and also by the obvious purpose of the treaty. When the treaty was entered into, the navigable waters on the boundary line west of Lake Superior were connected by portages, which were reasonably well defined and which naturally would be followed, but the Grand Portage, extending from Lake Superior overland to the Pigeon river, was of great length and subject to considerable change in accordance with the views of those who might use it from time to time. It was clearly necessary to define the Grand Portage by some description in the treaty, and this was done by inserting the phrase 'as now actually used.' It was evidently the intention of the treaty-making powers, in defining the boundaries, to secure to both countries the free and open use of the boundary waters for interior communication and transportation, and it would seem to be a narrow construction of the clause in question which would assign to those powers the intent to limit the right of communication and transportation to canoes, for this would place them in the position of utterly ignoring future conditions and practically destroying the value of the waterways as means of communication. The broader and proper construction, in the opinion of the commission, is that the intent was to preserve to both countries the 'free and open use' of the boundary waters, in any matter that they could be made use of for the purposes mentioned.

In the opinion of the commission, therefore, the permit to permanently divert waters which would supply the boundary lakes and streams, ought not to be granted without the concurrence of the Dominion of Canada.

Aside from the effect of the treaty of 1842, there are other considerations which lead the commission to the conclusion that the permit applied for should not be granted without the concurrence of Canada.

The proposed diversion will, to some extent, injuriously affect riparian rights upon the Canadian side of the boundary waters and will also affect the water supply of the Namakan river and other waters, wholly in Canada. The principles involved in arriving at this conclusion do not impugn the right of the United States to grant the permit, but they are of such great importance and of such widespread application that the commission believes they should be settled and applied by both countries.

As the necessity for an enormous increase in the appropriation of water wholly within one country has given rise in later years to conditions which never existed before, recourse to authorities upon international law for direct precedents is useless, but there are certain principles of international law which have a direct bearing upon the question under consideration and which should, in the opinion of the commission, be sufficient for their solution.

It can hardly be disputed that, in the absence of treaty stipulation, a country through which streams have their course or in which lakes exist, can in the exercise of its sovereign powers, rightfully divert or otherwise appropriate the

waters within its territory for purposes of irrigation, the improvement of navigation, or for any other purpose which the government may deem proper. This principle was lucidly stated by Mr. Harmon, Attorney General of the United States, on December 12, 1895, in a communication to the Secretary of State (opinions of Attorneys General, Vol. 21, p. 274). The question submitted to the Attorney General by the Secretary of State involved the right to appropriate the waters of the upper Rio Grande for irrigation purposes to the injury of residents of Mexico, and in giving his opinion the Attorney General laid down the law as follows: 'The fundamental principle of international law is the absolute sovereignty of every nation, as against all others, within its own territory.' He then quoted from Chief Justice Marshall's opinion in Schooner Exchange vs. McFadden, 7 Cranch, p. 136, the following excerpt:

'The jurisdiction of the nation within its own territory is necessarily exclusive and absolute. It is susceptible of no limitation not imposed by itself. Any restriction upon it, deriving validity from an external source would imply a diminution of its sovereignty to extent of the restriction, and an investment of that sovereignty to the same extent in that power which could impose such restriction.

'All exceptions, therefore, to the full and complete power of a nation within its own territories must be traced up to the consent of the nation itself. They can flow from no other legitimate source.'

Great Britain also has insisted upon the same principle in the matter of the navigation of the lower St. Lawrence. The history of the positions taken by the United States and Great Britain need not be recited, but it will be noted that Great Britain did not recede from her position and simply conceded by treaty the right of navigation upon certain concessions being made by the United States. It would seem, therefore, to be settled international law, recognized by both countries, that the exercise of sovereign power over waters within the jurisdiction of a country, cannot be questioned, and that, notwithstanding such exercise may take a form that will be injurious to another country through which the waters of the same streams or lakes pass, it cannot be rightfully regarded as furnishing a cause of war. But where the citizens of a country are injured by such exercise of sovereignty, international law recognizes (unless there is urgent necessity for its exercise), that there is a breach of comity which entitles the country whose citizens or subjects are injured, to retaliate. Sir Robert Phillimore, in his commentaries upon international law (edition of 1879, pp. 12 and 13), clearly draws the distinction between the international duties of governments as they affect public interests and as they affect private interests. He states the international law as follows:—

'The *obligationes juris privati inter gentes* are not—as the *obligationes juris publici inter gentes* are—the result of legal necessity, but of social convenience and they are called by the name of comity—*comitas gentium*.

'It is within the absolute competence of a state to refuse permission to foreigners to enter into transaction with its subjects, or to allow them to do so, being forewarned that the municipal law of the land will be applied to them; therefore, a breach of comity cannot, strictly speaking, furnish a *casus belli*, or justify a recourse to war, any more than a discourtesy or breach of a natural duty, simply as such, can furnish ground for the private action of one individual against another.

'For want of comity towards the individual subjects of a foreign state, reciprocity of treatment by the state whose subjects have been injured, is, after remonstrance has been exhausted, the only legitimate remedy; whereas the breach of a rule of public international law constitutes a *casus belli*, and justifies in the last resort a recourse to war.'

It would seem that comity would require that, in the absence of necessity, the sovereign power should not be exercised to the injury of a friendly nation or of its citizens or subjects, without the consent of that nation.

The common law protects riparian owners against permanent diversions of water which injuriously affect their rights, and this law is founded upon principles, not merely of social necessity, but of justice and right. While the common law is not a part of the law of nations, its principles so far as they are founded in justice and equity, ought, where practicable, to be applied by nations acting in their sovereign capacity. The Department of State of the United States has adopted this principle in the past, and although the application was made in the case of conflicting riparian rights on a boundary stream, yet the commission can see no sound distinction between the position taken by the government of the United States in the case referred to, and cases of diversion of water wholly within one country where the diversion injuriously affects riparian owners in another country. This application of the common law was made by Mr. Evarts, Secretary of State. It was complained that Mexicans upon the Rio Grande in the neighbourhood of El Paso, were diverting so much of the waters of the river for irrigation purposes as to seriously affect the amount which could be obtained by citizens of the United States for a like purpose. Mr. Evarts in a communication to Mr. Navarro, the Mexican Minister (June 15, 1880), directs his attention to the complaints, and after referring to the abstraction of water by the Mexican population for irrigation purposes, says:

'As this is not only in direct opposition to the recognized rights of riparian proprietors, but is also contrary to that good feeling and harmony which ought to exist between co-labourers in peaceful pursuits, and might, moreover, if permitted to continue, result in bitter feeling and possible breaches of the peace, I most earnestly request, in these high interests, that you will have the goodness to bring the matter to the attention of your government with a view to procuring a cessation of the annoyance complained of.' (Vol. 1, p. 63, Wharton's International Law Digest).

Mr. Farnham, while somewhat over-stating the law, in his work on 'Waters and Water Rights' (edition of 1904, vol. 1, p. 29), forcibly enunciates the principles which should obtain, citing authorities.

'A river which flows through the territory of several states or nations is their common property. Each is entitled to its navigation throughout its whole extent, so far as it can be exercised without injury to the rights of others. It is a great natural highway conferring, besides the facilities of navigation, certain incidental advantages such as fishery and the right to use the water for power and irrigation. Neither nation can do any act which will deprive the other of the benefits of these rights and advantages. The inherent right of a nation to protect itself and its territory would justify the one lower down the stream in preventing by force the one further up from turning the river out of its course, or in consuming so much of the water for purposes of its own as to deprive the former of its benefit. Conversely, the upper owner would have a right to prevent an obstruction of the stream which would prevent fish from ascending to its shores, or interfere with its rights of navigation. To prevent resort to force, courts of arbitration would protect these rights, and the courts of the respective nations will prevent acts on the part of their own subjects which interfere with the rights of subjects of other states. And courts having a supervisory jurisdiction over the acts of the political department of government will prevent acts by that department which will injure the rights of neighbouring states. The gifts of nature are for the benefit of mankind, and no aggregation of men can assert and exercise such rights and ownership of them as will deprive others having equal rights, and means of enjoying them, of such enjoyment. The acts of nations must be governed by principles of right and justice. The days of force and self-aggrandizement at the expense of neighbouring nations are

past, and the common right to enjoy the bountiful provisions of Providence must be preserved.'

Messrs. Jeremiah Smith and George B. French very fully and ably discuss in the *Harvard Review*, November, 1894, volume 8, number 3, the power of a state to divert an inter-state river. They said: 'Because Massachusetts can compel a sale of property in Massachusetts, it does not follow that it also can compel a sale of property in New Hampshire. Massachusetts has not the power to compel a New Hampshire riparian proprietor to sell his right (annexed to and arising out of his New Hampshire land), that the water of the river should continue to flow to his land. A state cannot exercise the power of eminent domain extra-territorially. Massachusetts cannot condemn land in New Hampshire. Massachusetts cannot, as against a citizen of New Hampshire authorize the doing of an act in Massachusetts which will result in the taking of property rights in New Hampshire. Massachusetts could not authorize the building of a dam in Massachusetts which would flood land in New Hampshire.

'By parity of reasoning, Massachusetts could not authorize the construction of an aqueduct or canal in Massachusetts which would divert water from a stream naturally flowing to New Hampshire. The right infringed by flooding New Hampshire land may be called absolute ownership. The right infringed by diverting water from the New Hampshire land may be called an easement. The consequence in the one case may be positive, and in the other case negative. But in each case it is a property right that is infringed; and the consequence is as direct in the latter case as in the former.

Massachusetts, even if an entirely distinct and independent sovereignty—even if standing to New Hampshire in the relation of France to Spain—would not have a right, under the rules of international law, to do this act. The law of nations recognizes no such right, even between states wholly foreign to each other. . . . . Massachusetts instead of merely denying New Hampshire's right to use, in Massachusetts, that part of the river which naturally flows through Massachusetts, is, in effect, denying New Hampshire's right to use, in New Hampshire, that part of the river which naturally flows through New Hampshire. Massachusetts, instead of saying to New Hampshire, 'You shall not hereafter use, in Massachusetts, that part of the common river which flows through Massachusetts,' makes a far more startling declaration. Massachusetts says to New Hampshire, "You shall not hereafter have the use of the river even within your own borders, for Massachusetts denies your right to have any part of thr river flow through New Hampshire.'

These principles were applied in the Holyoke Water Power Company vs. Connecticut River Company ((22 Blatch 131, 20 Feb., '71).

In this case the plaintiff claimed that its property located in Massachusetts would be injured by the defendants raising of a dam in the State of Connecticut. The defendant justified under powers given it by the State of Connecticut claiming that its proposed structure was in aid of navigation. A permanent injunction was granted enjoining the defendant.

The court, after holding that the State of Connecticut had jurisdiction over lands within its boundaries says, 'As Connecticut has no direct jurisdiction or control over real estate situate in another state, it cannot indirectly, by virtue of its attempted improvement of its own nvaigable waters, control or subject to injury foreign real estate.

'If this resolution is a bar to an action for any consequent injury to land or to rights connected with land in Massachusetts, Connecticut is acting extra-territorially.'

CONCLUSIONS.

The commission has arrived at the following conclusions:

1. While the work proposed by the applicant will be of great advantage to the interests served, it will interfere with public and private interests in Canada, and the commission see no public necessity for it.

2. The proposed diversion will injure the interests of various classes of persons, namely residents of the United States having property rights in the State of Minnesota, residents of the United States having property rights and interests in Canada and in the boundary waters, residents of Canada having property rights and interests in Canada, and municipalities in the Dominion of Canada. The rights and interests which will be affected are divisible into two classes, namely, those which depend upon navigation directly or indirectly and those which depend upon the use of waters of the various streams and lakes for power purposes.

3. The proposed diversion will affect injuriously navigation upon the boundary waters between the United States and Canada, above mentioned, and upon navigable waters in Canada connecting said boundary waters; but,

4. So far as water-power interests on the international boundary or in Canada are concerned, which depend upon the supply from the Birch lake drainage area, although remedial works at locations above Rainy lake may be constructed, the total amount of water can be stored and used for power purposes upon the boundary and connecting waters located wholly in Canada, will be diminished.

5. The applicant, the Minnesota Canal and Power Company of Duluth, Minnesota, under the decision of the Supreme Court of Minnesota, above cited, apparently has not the power to utilize the permit it seeks to obtain, but possibly may acquire that power. It would seem, therefore, that the permit which the applicant seeks, ought not in any case to be granted before it secures authority under the laws of Minnesota to utilize it.

6. That the rights and interests of the residents of Minnesota which may be affected by the proposed diversion, are of so much less importance than the interests which will be promoted by the proposed works of the applicant, that they do not furnish a sufficient reason for refusing the permit sought, inasmuch as full compensation must be made to such persons under the laws of Minnesota.

7. Neither the State of Minnesota nor the United States can provide the adequate means by which money compensation can be ascertained and made to the owners of the interests in Canada which may be injured, and it follows that individuals sustaining injury would be relegated to litigation. This is a violation of the principle of law that private property shall not be taken for public use, unless provision for compensation can be made without litigation and its attendant delays and expense.

8. So far as remedial works are concerned, it is sufficient to say that there is no jurisdiction in the United States or in the State of Minnesota to provide for or permit the erection of the necessary remedial works in Canada.

9. That although it might be advisable to grant the permit applied for, in case the applicant should acquire the powers necessary to utilize it, if objections arising from international relations did not exist, treaty provisions, international comity and the impossibility of providing just means of assuring adequate compensation for injury to interests in Canada, or of preserving navigation unimpaired on the boundary streams, without concurrent action of both governments concerned, lead us to the conclusion that the permit should not be granted unless the full protection af all interests not cared for by the laws of Minnesota be secured by concurrent action of the United States and Canada.

RECOMMENDATIONS.

1. The commission would, therefore, recommend that the permit applied for be not granted without the concurrence of the Canadian government.

2. As questions involving the same principles and difficulties, liable to create friction, hostile feelings and reprisals, are liable to arise between the two countries, affecting waters on or crossing the boundary line, the commission would recommend that a treaty be entered into which shall settle the rules and principles upon which all such questions may be peacefully and satisfactorily determined as they arise.

3. The commission would recommend that any treaty which may be entered into should define the uses to which international waters may be put by either country without the necessity of adjustment in each instance, and would respectfully suggest that such uses should be declared to be:

(*a*) Use for necessary domestic and sanitary purposes.

(*b*) Service of locks used for navigation purposes.

(*c*) The right to navigate.

4. The commission would also respectfully suggest that the treaty should prohibit the permanent diversion of navigable streams which cross the international boundary or which form a part thereof, except upon adjustment of the rights of all parties concerned by a permanent commission, and with its consent.

All of which is respectfully submitted,

GEO. C. GIBBONS,
Chairman, Canadian Section.

O. H. ERNST,
Brig.-Gen. U.S. Army, Ret'd.
Chairman American Section.

W. F. KING,
Commissioner,

GEORGE CLINTON,
Commissioner.

LOUIS COSTE,
Commissioner.

E. E. HASKELL,
Commissioner.

Attest,
THOMAS COTE,
Secretary, Canadian Section.

Attest,
W. EDWARD WILSON,
Secretary, American Section.

APPENDIX 'A'.

To the Honourable
The Minister of Marine and Fisheries,
Dominion of Canada.

The memorial of the undersigned municipal corporations, persons and corporations respectfully showeth:

That at the height of land in St. Louis and Lake counties, in Northern Minnesota, the waters from Birch lake and White Iron lake, and the streams running out thereof, and the immense watershed thereof, run northward and ultimately into Rainy lake and from there into Rainy river, passing into the Lake of the Woods.

That the water from this source forms by computation seven per cent of the water passing out of Rainy lake over Alberton falls at Koochiching.

That the water system of Rainy lake, Rainy river and the Lake of the Woods have long been established as a commercial highway.

That from the Canadian ports of Rat Portage and Fort Frances, two large and well equipped passenger and freight lines ply daily during the season of navigation, forming the means of water communication between the Canadian ports of Rat Portage, Rainy River town, Boucherville, Barwick, Emo, Big Forks, Little Forks, Isherwood, Fort Frances, Bears' Pass, Seine river and Mine Centre, and forming along a considerable part of such route the only vehicle of passenger and freight communication.

That the most important section of the 200 miles of navigation is the Rainy river, flowing through what is rapidly becoming a thickly-populated and prosperous valley for some eighty odd miles, with towns rapidly building up at close intervals on its banks, dependent almost wholly on the river route for their mercantile and manufacturing interests.

That the fine class of steamboats plying on this water is already, in certain portions of the summer, hampered by low water on the rapids and shoals of the river, and the proprietors of the regular steamboat lines have been earnestly petitioning for such improvement being made on the river as would remove such disability, a disability that compels the withdrawal for considerable intervals during each summer of some of the large and deeper draught steamboats.

That in view of the fact that navigation is already suffering for lack of adequate water in portions of Rainy river and in portions of Rainy lake, your memorialists are surprised and alarmed to learn that active steps are being taken by a corporation named the Minnesota Canal and Power Company of Duluth, Minnesota, to obtain the authorization of the Federal government of the United States, through the Commissioner of the General Land Office at Washington, to construct a dam or dams and canal to divert all the waters of Birch lake and White Iron lake watershed hereinbefore referred to, into the Embarrass river, and by it into Lake Superior, thus diverting from and robbing this long-established international waterway of Rainy lake and river of the large proportion mentioned of its tributary waters.

That if permission is given by the Federal government of the United States to the project of the said Minnesota Canal and Power Company, a disastrous injustice will be done to Canada, and American established navigation companies that are using the water highway of Rainy lake and river, and to the manufacturing towns along the river, both on the Canadian and United States sides. And a most dangerous precedent will be established, the consequences of which can hardly be estimated if any attempt to interfere with or divert from their natural flow be permitted of any portion of the waters of the great watershed lying between the Lake Superior slope and the northern slope.

Your memorialists would therefore, most earnestly pray that the government of Canada should, in the interest of this important international navigation route, at once communicate with the Federal government of the United States and take prompt and active measures to avert the disastrous consequences of permission being unwittingly given by the General Lands Office at Washington to any scheme to interfere with or divert any portion of the waters tributary to the international waterways aforesaid.

(Sgd.) W. J. KEATING, *Mayor of Fort Frances.*

(Sgd.) F. H. WARNER, *Clerk of Fort Frances.*

Fort Frances, Ontario 17, March 1904.

APPENDIX 'B'.

THE TOWN OF KENORA.

Whereas it has been reported that proposals have been made to divert from their present course certain lakes and streams in Northern Minnesota, which lakes and streams now form a part of the supply of waters of Rainy lake and river and the Lake of the Woods:

And whereas the diversion of these waters from their natural course is apt to cause a very material lowering of the waters of these lakes and river, thus entailing heavy losses to hydraulic power consumers, steamboat owners, and lumbermen who have invested their capital under existing conditions:

Therefore be it resolved that this municipal council of the town of Kenora do protest most emphatically against any interference with the natural flow of these waters, and that a copy of this resolution be forwarded to the Honourable Secretary of State for Canada, and to the Chief Engineer of the Deep Waterways Commission.

We hereby certify the foregoing to be a true copy of resolutions of the municipal council of the town of Kenora, adopted at meeting held July 4, 1906.

A. CARMICHAEL,
Mayor.

D. H. CUNIE,
Clerk.

APPENDIX 'C.'

RAINY RIVER NAVIGATION COMPANY, LIMITED.

KENORA, Ont., July 6, 1906.

J. G. SING,

Engineer in charge, Dept. Public Works,

Toronto.

DEAR SIR,—Mr. Carmichael, our mayor, has informed me that you wished to know what effect the diveting of any water naturally deeding the Lake of the Woods would have on the business of our company. To this matter I have given a great deal of attention , and have followed the course of the water supply of Rainy river very carefully, and I am convinced that the water supply is not sufficiently great to allow ofthe diversion of any of the water without causing very serious loss to the transportation business. Of course, I am not an engineer and cannot give you any figures with reference to this matter, but I can tell you from long practical observation that it would be a great detriment to navigation, should any water be diverted, as there is none to spare. I trust that our government will object strenuously to any diversion of the head waters of the Lake of the Woods.

Yours truly,

GEO. A. GRAHAM,
Manager.

APPENDIX 'D'.

KENORA, CANADA, July 4, 1906.

EXTRACT FROM MINUTES OF THE MEETING OF THE BOARD OF TRADE OF THE DISTRICT OF RAINY RIVER.

Whereas it has been learned by this board that an application has been made by the Minnesota Canal and Power Company for privileges to divert water from the Birch lake draining basin, in the state of Minnesota, to Lake Superior.

And whereas this board is assured that such diversion of the said water will have a serious effect upon the navigation of Rainy lake and Rainy river, by rendering impossible the present means of transportation for boats and vessels now plying upon the said waters, with a resultant heavy but undeserved loss to the owners of same, and a heavy blow to the trade and commerce of the district adjacent to said waters, and to the people relying upon the same, not only for means of navigation, but for power for manufacturing purposes.

Now, therefore, be it resolved that this board do hereby protest most emphatically against the diversion of the said waters as aforesaid, and would urge that the present levels of the said waters, having been adapted to existing requirements of navigation and the creation of electrical power, should be maintained.

And that a copy of this resolution be forwarded to the Honourable the Minister of Public Works and the member of this electoral district.

J. P. EARNFLY, *President.*

J. DEAN, *Secretary.*

APPENDIX 'E'.

Report of Mr. J. G. Sing.

TORONTO, July 21, 1906.

To the Chairman and Members of the International Waterways Commission.

GENTLEMEN,—I have the honour, in accordance with directions received from your honourable body during your recent meeting in Buffalo, to submit the following statement regarding the application of the Minnesota Power and Canal Company to divert the flow of certain waters forming the boundary between the United States and Canada, adjoining the state of Minnesota and province of Ontario.

I feel it would not be fair for any one to pass censure upon several of the technical arguments that have been advanced by the Minnesota Power and Canal Company in support of their application to divert waters from the drainage basin of Birch lake, unless any censure, so passed, was based upon exact knowledge resulting from special surveys and examinations of the territory likely to be affected by the diversion of said waters. Not possessing full data, resulting from such special surveys and examinations, I have considered it more profitable, for the purposes of your honourable commission, to express my views in the following manner:—

Permit me to make a few general remarks, and, first of all let me say, that deductions made from technical data and calculations, designed to exhibit

the very small effects which the additions or subtractions of bodies of water may have upon the levels of certain other bodies of water in nature, are deductions which experience, in actual cases, has sometimes failed to substantiate.

As is well known, the changes our climate is manifesting, the denudation of timber lands, especially in localities such as the districts surrounding Rainy lake, Lake of the Woods and like influences, directly affect the run off from the watersheds; and the volume of water discharged from watersheds may, in time, become so changed as to materially, and disadvantageously affect the navigable properties of any waterways to which such watersheds contribute their supply.

When one appreciates the fact that a variation of a fraction of a foot in the depth of a waterway may be the factor which determines whether or not boats are able to navigate a certain channel, one can hardly be content to regard, without apprehension, the total removal of waters which are capable of rendering even small aid to navigation at times when that aid may be most necessary.

And, while it may be argued, that if waters are diverted from certain channels so that the levels in those channels are detrimentally affected, then other waters, elsewhere, may be reservoired so as to compensate for the effects of said diversion; nevertheless, one must consider whether or not it be wise to thus utilize stored waters to relieve an artificially created condition, when the future might possibly disclose a set of natural conditions that could only be relieved through the employment of these same systems of reservoirs.

It is sense of the important bearing of the facts set forth in these remarks that cause me to say: that in my judgment, the absolute diversion, by the Minnesota Power and Canal Company, of the waters they desire, and which now contribute to the flow of waters in Rainy lake, and the Lake of the Woods and Rainy river, is a procedure which must disadvantageously affect the navigable properties of waterways which form a part of the international boundary between Canada and the United States.

In support of this opinion, I beg, respectfully, to submit the attached letters which express the views of parties whose interests are closely allied with the commercial navigation of some of these boundary waters.

It is apparent from these communications, that parties interested in the navigation of Rainy lake, Rainy river and the Lake of the Woods, view, with much apprehension, a proposal to divert waters after the manner proposed in the application of the Minnesota Canal and Power Company.

There is, however a phase of the discussion arising from the application of this company, which has appeared to me worthy of more serious and full consideration than, so far as I am aware, it has already had. That phase is the possible effect which the diversion of the waters of Birch lake drainage basin will have upon Basswood lake and the watercourses interconnecting it with Rainy Lake.

It may be recalled that in addition to the water route from Lake Superior, westward, via the Grand Portage and the International boundary, there is the Canadian water route which has been traversed by many, and with troops and supplies, by the Red River expedition, in the early seventies.

Entering this Canadian route at Thunder bay, one proceeds, either by the old canoe route of the Hudson Bay Company, or by the Dawson route to Lac des Mille Lacs, thence, onward via the chain of waters to the international boundary, joining the boundary at Lac la Croix. From Lac la Croix to Rainy lake water transportation, comparatively good for this territory, is met with.

Now, Basswood lake, which is capable of being navigated by small steamers, also forms part of the international boundary lying to the east of Lac la Croix, and the waters of Lac la Croix are largely contributed to by the flowage through, and from, Basswood lake, which lake in turn, is chiefly fed from the waters which flow into it from the Birch Lake drainage basin.

The question therefore arises, what effect will the diversion of these Birch lake waters have upon the levels in Basswood lake, in Lac la Croix, and in those other waters which constitute the highway of water transportation to Rainy lake, Rainy river, Lake of the Woods and on to Lake Winnipeg?

In the course of the discussions which have taken place, with respect to the application of the Minnesota Canal and Power Company, the applicants have undertaken to show that the removal of the volume of water which they desire to divert from the waters which now contribute to the flowage along the international waterway, would have a comparatively small effect upon the levels of Rainy lake and the Lake of the Woods, owing chiefly, to the large areas of the watershed and great storage capacities of these bodies of water.

While it may be true that the area of watershed, viz., 670 square miles, corresponding to the volume of water, viz., 600 cubic feet per second, propose to be diverted by the Minnesota, Canal and Power Company, is, according to the data supplied by this company's engineers, approximately only four per cent of the total area tributary to Rainy lake, and approximately only 2·3 per cent of the total area tributary to the Lake of the Woods, yet, this area of 670 square miles, corresponding to the proposed diversion, is approximately 37 per cent of the total area tributary to Basswood lake.

In the absence of data giving the annual ranges of water levels on Lac la Croix and Basswood lake, I am unable to indicate the amount of the changes in levels, which the proposed diversion of Birch lake waters would entail. It seems evident, however, that a diversion of the waters of the Birch Lake drainage basin to the extent just stated, of 37 per cent of the total area tributary to Basswood lake, undoubtedly have an immediate and great effect upon the levels in Basswood lake, and this effect would probably be noticeable to navigators along the watercourses connecting Basswood and Rainy Lakes. In other words, it might be affirmed that part of a great system of waterways, of more or less navigable waters, would be detrimentally affected by diverting from their flowage the waters proposed to be diverted by the Minnesota Canal and Power Company.

Again, when we consider the vast energies and sums of money which have actually been spent, and which, annually, are being expended by nearly all countries upon their internal waterways and canals, and when we consider, also, the chain of waters connecting—through many portages it is true—Lake Superior with the west, it might be too hasty a conclusion for any one to state, that for navigation purposes, these waters might not be much improved. If such improvement is ever to take place, might it not require all the water naturally shedding from the territory through which this great waterway passes? Capitalists are reported to have already proposed the canalization of the waters lying between Lake Superior and Lake Winnipeg. In the particular territory under discussion, railway traffic through Fort Frances and Kenora could be better regulated if the waterways, along the international boundary, were kept open for the best water communication they were able to afford.

Clearly, if enterprises, such as the Minnesota Canal and Power Company could obtain the right to divert waters from channels having present, and admitting of future, improved navigation, then through such precedent, much of the safeguard to the interests of navigation would be removed.

In conclusion, I may say that I find myself unable to report with favour upon an application such as has been made by the Minnesota Canal and Power Company, until such time as it would be demonstrated that the interests of navigation in future, would not be compromised by the removal of waters diverted after the manner in which the Minnesota Canal and Power Company propose to divert part of the waters which, naturally and materially contribute to the flowage in the navigable channels of the international waterway between Canada and the United States.

In speaking of the canalization of the waters between Lake Superior and the Lake of the Woods, I find, upon reference to the report of the engineers who made the survey, that there are 311 miles of navigable waters between the summit near Lake Superior and the Lake of the Woods, and by the proper arrangement of a series of stop-log dams, and the construction of locks, these waters can be fully utilized for transportation purposes. The navigation, as proposed, would entail very little canal work, as the cutting would not amount to more than one mile in the entire distance of 311 miles.

In the development of this route, there is under the present natural conditions, plenty of water, if conserved judiciously, for feeders, but it would not be safe to allow a diversion of any portion of the flow in an opposite direction to that intended by nature.

The total cost of opening up this route has been estimated at $1,500,000, by the engineers who made the survey.

This waterway, if fully developed, would prove a safeguard against excessive rates being charged on any railway that might parallel it.

I have the honour to be, gentlemen,

Yours obediently,

J. G. SING,
Engineer in Charge.

THOMAS COTE, ESQ.,
Secretary, Canadian Section,
International Waterways Commission,
Toronto, Canada.

MEMORANDUM

TO THE DEPUTY MINISTER OF PUBLIC WORKS IN REFERENCE TO POWER DEVELOPMENT AT MASSENA, N.Y.

September 1., 1906.

This question was brought before the Commission by a letter from the Secretary of the Department of Public Works, dated April 28, 1906, enclosing a letter from the Calvin Company Limited of Garden Island, Ont., to the Honourable the Minister of Justice, protesting against the construction of a dam, said to be contemplated by the water-power company operating at Massena, N.Y. in the channel of the St. Lawrence river south of the Long Sault Island.

It appears that the Calvin Company, Limited, were informed that this American company was asking the Government of the United States for permission to dam the south channel of the river at Long Sault island. This south channel is used by small boats and by rafts whilst the north channel is that usually used by the Richelieu and Ontario Navigation Company's steamers and other passenger boats and freighters. Long Sault island belongs to New York state, and the south channel, therefore, lies wholly in the United States. The Calvin Company, fearing that the construction of a dam in that channel would completely put an end to all navigation of it, requested the Department of Justice to take the necessary steps to prevent, if possible, the proposed obstruction.

The Honourable the Minister of Justice expressed the view that 'by Article VII of the treaty between the United Kingdom and the United States of America of 1842, commonly known as the Ashburton treaty, it is agreed that, amongst other matters therein mentioned, the channels in the River St. Lawrence on both sides of Long Sault island and of Barnhart's island, shall be equally free and open to the ships, vessels and boats of both parties to the treaty, and that, therefore, it would obviously be a breach of the obligation of the United States under this clause VII, if permission were granted to erect any structure which would prevent or materially obstruct the navigation of the channel in question'.

The Minister of Justice further expressed the opinion that the erection of such a dam may also seriously affect Canadian interests, public and private, by the effects which it would produce upon the north channel of the river and otherwise, and a protest against the grant by the United States War Department of a permit to a water-power company at Massena, N.Y., for the construction of the proposed obstruction was sent to His Majesty's Ambassador in Washington on February 3, 1906.

The United States Secretary of State, Honourable Elihu Root, replied to the Canadian protest on May 18, 1906. It does not appear by Mr. Root's statement to the British Ambassador that the power company operating at Massena, N. Y., has made any application to the United States Secretary of War for the construction of any kind of work. But the St. Lawrence River Power Company has obtained permits for work in the St. Lawrence river as follows:

1. Under date of July 10, 1901, permission was given to dredge a channel 150 feet wide and 18 feet deep through the shoal or bar in the south channel of the river at the head of Long Sault Island.

2. Under date of March 20, 1903, permission was granted to dredge a channel in the river through the shoal above the entrance to the company's

power canal between the main land and the westerly end of Long Sault Island, and to deposit dredged material in said river.

3. Under date of August 30, 1901, permission was granted to build and maintain a permanent jetty or dyke in the river at the entrance of the Company's power canal.

4. Under date of August 3, 1903, permission was granted to change the dyke construction for which permission was given August 30, 1901, and to build and maintain the same at a different location.

At the request of Secretary of State Elihu Root, the Secretary of War directed an examination to be made of the work done in the St. Lawrence river by the St. Lawrence River Power Company. An examination was made by Engineer John C. Churchill on March 31, 1906, and the following information was obtained from him:—

'No work has been done by the company under the permits of July 10, 1901, and March 20, 1903, for dredging at the head of Long Sault Island.

'Under the permit of August 30, 1901, for the construction of a jetty or dyke in the river, the dyke was built, but it did not accomplish its purpose.

'Under the permit of August 3, 1903, for the construction of a new dyke to replace the one built under the permit of August 30, 1901, the old dyke has been entirely removed and a new one constructed in accordance with the approved plans.

'It is stated by Mr. E. B. Bumsted, General Manager of the St. Lawrence River Power Company, that measurements taken by Mr. John R. Freeman, civil engineer, under his direction, showed that the largest amount of water, which had been diverted by the company from the St. Lawrence river up to the present time was 7,700 cubic feet per second. Mr. Bumsted also stated that it was contemplated by the company to increase the development some time in the future, so that the amount to be diverted will be approximately 14,000 cubic feet per second.

'Measurements taken in September, 1904, by Mr. Freeman for the St. Lawrence River Power Company, showed the total quantity of water passing through the south channel of the St. Lawrence river at Long Sault rapids to be 45,000 cubic feet per second.

'It appears further from Mr. Churchill's report that the intake of the company's power canal is located about one mile below the head of the south channel of the St. Lawrence river at Long Sault Island; that the effect on navigation of the diversion of the water up to this time is little or none, and that all the water taken by the company is returned to the St. Lawrence at the foot of Long Sault rapids, about eleven miles below the power canal intake through Grass river which from the power house to its mouth, is used as a tail race for the power canal.'

The works of the St. Lawrence River Power Company have been the subject of a report made at the request of the Canadian Government by Mr. Robert C. Douglas, hydraulic engineer of the Department of Railways and Canals. This report is dated June 13, 1903, and it will be found at Appendix A.

No action has been taken upon Mr. Douglas's report, and there seems to be no record of any protests against the works of the St. Lawrence River Power Company as authorized by permits of the United States Secretary of War in 1901 and 1903.

At any rate the protest of the Calvin Company, Limited, was carefully inquired into by the commission. On May 1, 1906, a letter was addressed to the St. Lawrence River Power Company requesting some details and making inquiries concerning their proposed operations. In reply a letter was received from Mr. Arthur V. Davis, general manager of the Pittsburg Reduction Company, stating that his company had acquired the property of the St. Lawrence River Power Company, but as it had been in possession only a few days, the plans so far as

the new management was concerned were very vague, but that they would be willing to furnish all information, plans, etc., that might be desired.

The canal of the company extends from the St. Lawrence river near the head of Long Sault island through a portion of the state of New York to Grass river, which forms the tail-race of the canal returning its waters to the St. Lawrence river near Massena Point.

But no work is being done at the present time under any of the permits of 1901 and 1903, and there is no record of any application either to the State of New York or to the United States Federal Government for permits for another dam or dyke.

The former owners of the works, viz: the St. Lawrence River Power Company, had in mind the possibility of extending their works by placing another dam across the south channel at its lower end. With this in mind, it is understood they acquired options on a few pieces of property that would be partially submerged by the construction of such a dam; it thus became known locally that such a plan was under consideration, and it is probable that this is the dam to which the Calvin Company refers. The plan for such a work, however, did not reach such a stage as to lead the St. Lawrence Power Company to apply for permission to dam the south channel. While it is possible that the new company, viz: The Pittsburg Reduction Company may desire to carry out this plan, it is the present understanding of the commission that they have no immediate intention of making application for such a permit.

In view of these facts, no action was thought necessary upon the question referred to this commission by the Secretary of the Department of Public Works.

The Commission, however, is now considering an application which has been made in the month of May last by Mr. Smith L. Dawley, of Ogdensburg, N.Y., for permission to construct dykes, retaining walls and such other structures as may be necessary for the development of a water-power in connection with navigable approaches to a summer resort on the United States side of the Long Sault Rapids in the St. Lawrence river. It is probably that water-power development which has been talked about to the Calvin Company, Limited, and which has arisen their suspicion. The scheme of Mr. Smith L. Dawley has not yet taken any definite form. He explained his proposition to the Commission at a meeting held in Toronto on July 24, and his statement is appended marked "B" and "C." In view to have a comprehensible idea of the locality where Mr. Dawley proposes to erect his works, the secretary of the American section under instructions of the Commission visited the locality during the summer and prepared a map showing that portion of the St. Lawrence river in the vicinity of Long Sault island and the proposed dyke. This map is to be found attached to page 406.

The whole respectfully submitted.

THOMAS COTE,

Secretary Canadian Section.

The Deputy Minister of Public Works,

Ottawa.

APPENDIX A.

REPORT upon the Power Development at Massena, N. Y., by Mr. Robert Douglas, C. E.

OTTAWA, June 13th, 1903.

DEAR SIR:—I submit the following report upon the St. Lawrence Power Company's Canal, at Massena, New York State, and its effect upon navigation canals, upon the St. Lawrence river, from the head of the Cornwall canal to the head of the Galops canal.

The sketch shows the relative location of the power canal with reference to the Cornwall and Farran's Point canals.

The canal is about three miles in length to the power house at the Grass River. It is in heavy cutting from thirty-five to eighty feet in depth to the crest of the bluff of the Grass River gorge.

The excavation and construction were commenced for a canal, of dimensions 262½ feet in width at the water level, side slopes 1½ to 1 and twenty-five feet in depth of water. The water canal section, as at present designed, is to be 268 in width, upon the water line, with side slopes 1½ to 1 and 18 feet depth of water.

The Grass river is utilized for a tail-race, and discharges into the south channel of the River St. Lawrence, above Cornwall Island, some six miles from the power house.

The power house—founded upon rock on the edge of the Grass River gorge which is some 60 feet deep below the original surface of ground—is 320 feet in length, its ultimate length will be 700 feet when the full capacity of the canal is developed into power.

At the head of canal, there are no guard gates, or any means of excluding the water of the river from the canal.

This is a variation from similarly situated water-powers. The reason of this omission, as surmised, is on account of cost of the necessary works, it being intended to use the canal for navigation of vessels to the manufacturers, to provide sluice-ways and navigation gates would entail large additional expenditure, in fact the canal has been surveyed by U. S. engineers for navigable purposes; by the construction of a lock near the power house and the deepening of Grass river it would afford a navigation entirely in U. S. waters.

It has been assumed that the concrete dam, founded upon rock, with sluice-ways and gates, immediately above the power house, by which the waters can be shut off the penstocks, and the end embankments preclude the necessity of protection works at the head of canal; the apparent elements of risk are at the embankments at the present ends of power house and dam. The finished, or westerly, end with heavy embankments presents no element of danger. The unfinished end which provides for the extension of the power house is protected by a, presumably, temporary framed, timber wing dam bolted to the rock and extended into the natural and undisturbed ground, an embankment with roadway behind it. Since the leak, or break, the embankment has been enlarged and riprapped with stone and has every appearance of stability.

In my former report it was stated that if the bank had been washed through 'it would have been nearly impossible to arrest the flow of the river'.

In order to avoid misconception it might have been added 'by ordinary temporary means' such as filling in stone, brush, bags of earth, &c.

To arrest the flow, if the bank had been washed out, would have required a lengthy period to construct, probably, a crib dam across the entire canal at some favourable situation.

With this general description I will take up the effect of the canal upon the St. Lawrence navigation If a technical description of the construction of the various works and the method of development of the water power is required, it can be made the subject of another report.

At present only a small amount of power and flow of water are used, for electric lighting and water works. There are now being installed generators for the full capacity of the water wheels in place and the present power house some 35,000 h.p. The Pittsburg Reduction Company and other companies have in construction large works. When this amount of power is in operation if there is demand for more power the power house will be extended and a further development of 30,000 h.p. made, or in all some 75,000 h.p. In discussing the effect of the withdrawal of the water from its natural course the full development of 75,000 h.p. will alone be considered.

The subtraction of the quantity of water, required for this amount of power, will permanently lower the water of the St. Lawrence river from the head of the Cornwall canal to the head of the Galops and theoretically the depression will extend to Lake Ontario.

The natural question arises to what extent, or the number of inches, the river will be lowered at the various mitre sills of the canals.

There are intricate technical mathematical formulæ in connection with this subject. There is no data available for their application; the cross-sections of river, the velocity of flow, the hydraulic gradients, or surface slopes of river, the direction and velocity of current, I have not been able to obtain. Even with this information available, the fact, that, at the inlet of the power canal, the river is broken by islands into several channels with rapid water and diverse currents, renders the calculation, of a definite number of inches, a theoretical approximation.

The U. S. engineers of the War Department have made extensive surveys, examinations and gaugings with reliable instruments and appliances, to determine the discharge of the St. Clair and Niagara rivers, and to determine the increment and decrement of discharge due to the rise and fall of the water levels and the enlargement and contraction of channel.

At the St. Clair river, as the result of the formulæ deduced, the withdrawal of 10,000 cubic feet per second for the drainage canal at Chicago would result in the course of six years in the lowering of the level of Lake Michigan-Huron some $6\frac{1}{4}$ inches.

The withdrawal of the quantity of water as projected by the power company at Massena, will amount to some 8 per cent of the discharge of the St. Lawrence river at Ogdensburg, as determined by the U. S. engineers, the withdrawal of the same percentage of discharge of the St. Clair river would lower the normal water levels some $9\frac{3}{8}$ inches.

At the Niagara river from data obtained by another party the U. S. engineers the withdrawal, through an independent outlet, of 8 per cent of the discharge of the river would lower its level some 9 inches.

The application of this data to the River St. Lawrence at the head of the Cornwall canal is influenced by different conditions; at the discharge sections, selected by the U. S. engineers, the river was comparatively straight and uniform and not affected by islands. At the entrance of the power canal the river is broken by islands with two channels and a cross channel.

If it is assumed the normal of the river would be lowered at the head of the Cornwall canal 9 inches, the level of water upon the mitre sills of the other canals would be lowered in a lesser degree corresponding to their distance from the canal, and the hydraulic gradient of the various falls, or rapids, and intervening stretches of river.

As remarked previously the information available upon the subject is limited. I have been informed for some seasons past the U. S. engineers have

been making a survey of the River St. Lawrence from Ogdensburg to below Cornwall. Endeavour will be made to obtain further information upon the subject.

The usual daily readings, by the lockmasters, of the levels of the river at the various canals previous and subsequent to the subtraction of water will give some indication of the effect of the proposed withdrawal of water when the full power has been developed.

To obtain reliable data self-registering water gauges should be established at the head of the various canals, at Prescott and if there is not now one in operation under the control of the Department of Public Works, one might be set up at Kingston.

At Sault Ste. Marie the water-powers upon the U. S. and Canadian sides are controlled by the Michigan Lake Superior Power Company. I understand the full development projected will withdraw over 50 per cent of the flow of the River Ste. Marie.

An Act of Congress throws upon the company the responsibility of maintaining the normal level of Lake Superior and invests the government with authority to limit or stop the withdrawal of water in case of failure to comply with provisions of the Act.

To compensate for the water not withdrawn, about 480 feet of the crest of the rapids has been dammed. One-half by a rock filled dam, the other half by four "stoney" sluices.

To maintain the normal level of the river, at the head of the Cornwall canal, would require a dam in some channel of the river, below the power canal, that would hold back and control a natural discharge of the river which would compensate for the amount of water withdrawn for power.

The government's position is analogous to that of U. S. government, in the first development of power at Sault Ste. Marie, previous to the construction of the water-power canal upon U. S. side and a compensation dam, the Canadian water-power development withdrew some 16 per cent of the flow of the river affecting the level of water in the U. S. and Canadian canals in a similar manner as it will be affected at the head of the Cornwall canal.

I have the honour to be,

Sir,

Your obedient servant,

(Sgd.) ROBERT C. DOUGLAS
Hydraulic and Bridge Engineer.

COLLINGWOOD SCHREIBER, Esq., C.M.G.,
Chief Engineer,
Railways and Canals.

DELANEY ISLAND

LONG SAULT ISLAND

DELANEY BAY

TALCOTTS POINT.

STATE OF NEW YORK

Portion of
SOUTH SAULT CHANNEL
SHOWING
ENTRANCE TO THE CANAL
OF THE
ST LAWRENCE RIVER POWER COMPANY

Scale
0 100 200 300 400 500 600 700 800 900 1000
in feet.

DYKE constructed under PERMIT of AUG 3 1903

DODGES LANDING

ABANDONED ROAD

PRESENT ROAD

FORCE CH

MASSENA CANAL

5
33A

ONTARIO

GRAND TRUNK RAILWAY

CANAL

CORNWALL

WATER POWER

SHEIKS ISLAND

RAPIDS

BARNHART ISLAND

PROPOSED DYKE

SAULT

LONG ISLAND

POLLYS RAPIDS

ROBINSONS BAY

DIBBINSONS LANDING

WAGNERS ISLAND

GRASSY ISLAND

Dumping Ground

PROVINCE OF ONTARIO

NEW YORK

FARRANS POINT

CROILS ISLAND

LONG SAULT ISLAND

SOUTH SAULT

N

S

LITTLE GUT

POWER CANAL

STATE OF NEW YORK

CAT ISLAND

INTERNATIONAL WATERWAYS COMMISSION.
AMERICAN SECTION.

MAP OF A PORTION OF
THE ST. LAWRENCE RIVER
IN THE
VICINITY OF LONG SAULT ISLAND.
SHOWING ENTRANCE TO
CANAL OF THE ST. LAWRENCE RIVER POWER CO.
AND THE
DYKE PROPOSED BY SMITH L. DAWLEY.
JUNE 1906

Scale in feet.
0 500 1000 2000 3000 4000 5000

NOTE.

Traced from Sheets 2 and 3 of Reservoir of St Lawrence River 1901, U.S. Lake Survey except in immediate vicinity of entrance to St Lawrence River Power Company's Massena Canal for which data were obtained from surveys of that Company.

All soundings are in feet below Standard Low Water corresponding to Lake Ontario elevation 242.95. Contours are in feet and elevations above water surface.

International Boundary, reestablished from Treaty Maps. ——·——·——
Line 300 feet from North shore of Long Sault Island ·····
Dyke proposed by Smith L. Dawley ——

5
33A

APPENDIX B.

(Statement of Mr. Smith L. Dawley on his proposed development of Power at Long Sault Rapids.)

OGDENSBURG, N.Y., July 20, 1906.

To the Chairman and Members of the
International Waterways Commission:

GENTLEMEN,—There exists on the south shore of Long Sault Island conditions favourable to the creation of a very attractive resort and of a hydraulic power of no small proportions. Preliminary surveys show that in a distance of 7,500 feet, there is a fall in the St. Lawrence river of 20 feet and that the bed of the river for a distance of 3 to 500 feet from the Island shore line is rock and the water very shallow favouring the building of a dyke of a very substantial character at a comparatively reasonable cost. The retaining wall will be built of stone and concrete.

With your approval it is proposed as shown on accompanying blue prints of plans, to build a dyke and thereby form a canal with power house, spillways, etc., to utilize the fall referred to.

It is intended that the flow of water through the canal will equal as nearly as possible the present flow of the river through the cross-section of the dyke and canal, the object being not to affect or alter the present velocity and depth of the remaining, or main channel of the river. Cross-sections of the dyke and power house are shown on the blue print, the current velocities in the rapids are also shown there at from 3 to 12 miles per hour.

The accompanying plans show a cross-section of 300 feet by 15 feet in canal, giving a flow at 2 miles per hour of 792,000 cubic feet per minute which is as near the present flow in the cross-section of canal and dyke as is possible to ascertain without very expensive measurements owing to the character of the rapids. This flow would give approximately 25,000 horse-power with a modern hydraulic plant as shown on drawing which with spillways will regulate the flow of water at all times.

The Island banks are composed of gravel, clay and hardpan, while the canal bank on the Canadian side is rock with the top grassed over. However, our operations would not affect the latter banks in the least for there is a current rushing down the channel between at the rate of 12 miles per hour. While we might deepen the water in the channel the Canadian banks would not be affected, neither at the time of construction, or after the completion of the plant. The principal work we would do is to build a retaining wall of stone and cement about 36 rods long nearly parallel with the Island shore and about 300 feet distant therefrom. This with the dam at the lower end and the power house of the same material would complete our works in the water. We estimate that it will take from two to three years to construct the work.

Your petitioner and his associates have secured the lands and properties to be affected by the proposed development and is confident that with your approval, the development will be pushed to completion speedily, and that the expenditure of the large sum necessary and the utilization of the power will be of immense benefit to this section of the state. Our citizens are very much interested in this enterprise, they believing with us that these natural facilities should be utilized as the Canadian Government is permitting them to be used on their side. In fact this rather barren north country can only keep pace with the more favoured sections by the development of the facilities nature has left here. I therefore beg your favourable consideration at this time.

Respectfully submitted,

SMITH L. DAWLEY.

APPENDIX 'C'.

(Public hearing on the application of Smith L. Dawley, for power development at Long Sault Rapids.)

TORONTO, July 24, 1906.

Messrs. S. L. Dawley, Senator Geo. R. Malby, of New York, and H. H. Warren appeared before the Commission at 12 o'clock noon July 24, 1912.

CHAIRMAN GIBBONS: The Commission have had your plans before them and would be very glad to hear anything that you want to say by way of supplementing the matter. I do not know whether your company or this proposed company —what the financial position is, whether you have got that far yet and would be glad to have any further or more definite information than is given by these plans.

SENATOR MALBY: Mr. Chairman and Members of the International Waterways Commission. Mr. Dawley, who has made this application, is a neighbour, a friend of mine residing in Odgensburg, and has requested me to come along and render such assistance by way of explanation and information as I may have. I have resided in this territory here covered by these maps or substantially in that territory all my lifetime, having been born in St. Lawrence county and I am more or less familiar with those particular places. Some years ago a project was undertaken to develop power by the Massena Power and Water Company, with which this Commission is no doubt familiar, the charter of which was secured from the State Legislature, I having had the honour of introducing a notice for the application for same. I mention that only as showing the familiarity I may have with the locality as that is within that immediate direct locality, being directly opposite the Massena Power Company's works at what is called the Long Sault Island. Now speaking generally upon the matter, which perhaps will not require a great deal of explanation, of course you gentlemen, at least some of you, understand that St. Lawrence County is a great deal like the Canadian territory which is on the north, it is substantially an agricultural community except so far as we are able to develop it by its natural resources. The people of that locality are of course very anxious to take advantage of any natural conditions which may exist in order to develop the country and contribute generally to the prosperity of its people. I may say with reference to financial matters it might be something which Mr. Dawley and his friends would be somewhat modest about speaking of, that Mr. Dawley and his backers are well known in our community as people who are absolutely responsible, financially and otherwise. Mr. Warren, who is connected with him in the enterprise, was the founder and the originator and the promotor and one of the builders and stock-holders of the Massena Power Company, which spent something like $10,000,000 and has a very large plant in successful operation. So the proposition itself does not spring from associates who did not intend to do anything, but it has sprang from sources which have opened up and accomplished work of this nature before. So far as their company is concerned which they propose to form, which is proposed to be formed for the construction of that work, it has not been up to the present time absolutely incorporated because they had been waiting somewhat on the proposition, as to whether it should go through or not; but I think I may say to you with proper assurances that if this grant is made that such a company will be formed for successful operation. Of course I repeat it is a very great interest and advantage to our people in our north country. We have spent there in the county of St. Lawrence in the development of its water power during the past fifteen years in the neighbourhood of $15,000,000. Streams running down from the Adirondack Mountains have

been utilized and firms such as the Remington Paper Company have been located. The Hannawa Falls Power Company is developing over 8,000 horsepower and have spent a million dollars and perhaps more, and we are constantly trying to develop that rugged country and make it not only an agricultural community but somewhat of a manufacturing community and we are meeting with success. Our enterprises have not been idly undertaken. They have been undertaken by men of ability, financially and otherwise, and in every single instance there has been never a flash in the pan but what has been a successful enterprise and today each one of these enterprises is an absolutely successful operation, financially and every way. Now you have before you the maps in the matter. I understand from your correspondence which Mr. Dawley has shown me that this Commission referred the matter to a member of your Commission, to Professor King, and it might be quite useful to us and me if we know exactly or in substance what Professor King's report might be on the project, and I assume you will be somewhat influenced to give consideration to what he may be pleased to recommend and to state what the facts are. Of course the map which is before you directly outlines, exactly outlines the work. They propose to build a dike from the power part of the Sault rapids for the distance of about 300 feet around to a point at the head of the rapids, building the dyke of sufficient height at the east end so as to be substantially of the same level as the water at the head of the canal, thereby establishing a water power at the base. Now as to what effect that would have to have on what is called the Long Sault Channel, being simply a layman like some of you gentlemen, it seems to me that it might be a matter of guess on what you regard good maps of the situation. Of course it is not proposed to stop water running through the canal. The object of course is when the powerhouse is in operation to flow the water through the canal. It would not be like a dam at the head of the rapids and thereby compelling all the water to go by way of the Long Sault, but on the contrary to create a canal for the conducting of the water to the power house and from thereon. The plans which are before you also provide, specify and show the spillway which is to take care of the water in case the wheels are not in active operation. Of course if the plant is in active operation the canal would substantially carry off all the water which would come in that direction now. If you will look at the map you will discover, for instance, there a spot located where I point which indicates a depth of four feet of water and down here three feet of water; here it is six; this point thirteen, and this five feet. Of course if enlarged to make a perfect canal that bed must be dug to a substantially uniform depth, which would create a greater passage than that which exists at the present time and might therefore take care of all the water which would naturally flow this way. However, that may be. Of course the amount of water which might possibly be thrown into the rapid channel there would strike one as not creating a sufficient amount of flow which would have a very great effect upon rapids as the Long Sault. Of course if it were still water and dammed back into still water it might increase the depth somewhat, but to flow it back into rapids which have a descent of nearly 30 feet in the course of a mile or mile and a half it would not ordinarily appear to a layman that it would increase the depth of water very much. We are not entirely wanting in actual experience as to the effect that might have. It was my pleasure and professional duty to act for the Canadian Government, for their Department of Railways and Canals in an application made to the Government of the United States to build a canal from an Island at the head of the Gallops Rapids to what was called Dawson's Island, which is perhaps six miles below Odgensburg; that is the head of your canal system beginning at Iroquois, your canal being on that side and the Island being here and the American Channel over here. The proposition was to build a dam across between the two islands. It is about 400 feet wide and 600 or 800 feet

long. The claim was made by the owners of the American Island, Dawson Island, that it would increase the flow of the water around the American island and thereby incur great damages. The matter was very thoroughly investigated and it was reported by the American engineers and the Canadian engineers that in their judgment such a thing would not take place, because they considered that there was not enough water to cause any perceptible rise in the rapids as the water was carried off so rapidly down the incline that it was substantially impossible to increase this depth by any considerable extent by the stoppage of the flow of that water. That was the report of the Canadian engineers to the Canadian Government and of the American engineers to the Washington Government. That was the best they could do, to give it as their judgment that no such thing would take place. Finally an agreement was made with the owners of the property which was satisfactory to everyone and the dam was constructed and is constructed today and there is upon the American side of the Island, toward which they supposed the flow would be more or less directed. there is not appreciable increase in the flow of water. There was absolutely no damage done to the Island; no one is able to say that the water has been increased to the slightest extent whatever. So I say in making an estimate or statements in reference to the property affected by dyking this strip here we are not wholly without actual experience in other grounds under similar circumstances, almost exactly identical circumstances so to what we have here. Now you desire the form of the canal. That is shown on the map here. I do not know that there is anything further that I can answer. I know of course the Canadian canal goes on down through here. As I understand a portion of that a little further south, quite a portion of water from the canal here is used for power purposes. The stream of course as you readily understand flows with great rapidity down there and there seems to be space enough to carry off the water. I do not know what the expert engineers would say about it. I would like to have an opportunity of making a reply to any suggestion which the engineers might make. I want to assure you that our people are very much interested in this project because from the little village of Massena, which was a dead village in our north country a few years ago we have now as thriving a village as there is in the state. The Pittsburg Reduction Company have a plant there which employs something like 700 men and it adds greatly to the prosperity and wealth of our people. This would add still more to our community and they are very much interested in having this application granted if it can be allowed with propriety.

Mr. CLINTON: For the information of the Chairman the statement furnished with this map contains the assertion that the applicants have acquired the land.

Senator MALBY: Yes, that is a fact.

Mr. CLINTON: That means they have a title to it?

Senator MALBY: They have entered into a contract with the owners of that property, an absolute contract, one of which at least I have examined and I am informed the others are similar to that, which gives them the absolute right to take that property at a given price in case the application is granted. I have stated to the Commission that the legal title to all this property which is to be affected by this is in the applicants. I do not mean by that that they have the title in fee simple. They have an absolute legal option upon all this property to be affected. The contract is absolute and they have the absolute legal right to take that property whether the application should be granted or not. The property is theirs if they want it upon the terms of the agreement, so that there is no private interest to be affected other than the interests which they themselves represent. Is there anything further?

Brig. Gen'l. ERNST: What limit of time would you wish, time of beginning and completing these works?

Senator MALBY: I would prefer to refer that to Mr. Warren or Mr. Dawley.

Mr. DAWLEY: We have stated that we would hope to complete the construction inside of three years. We have some preliminary plans now that we thought would enable us to start operations this season if we were granted the permission and would endeavour to hasten these operations as rapidly as possible and assure the Commission the plant would be in operation three years hence.

Senator MALBY: It might be granted on that condition?

Mr. DAWLEY: Yes.

Senator MALBY: I assume if the plant was substantially completed at the end of that time this Honourable Commission would see we were proceeding in the utmost of good faith and by reason of difficulties which we have sometimes that we were unable to complete it by that time and extension would be granted; but that would be our best judgment.

Brig. Gen'l. ERNST: As I understand you, your expectation would be that you would begin work within one year and finish it in three years, two years from the time of beginning?

Mr. DAWLEY: Three years from this time.

Brig. Gen'l. ERNST: Beginning work within one year?

Mr. DAWLEY: Yes.

Mr. CLINTON: I would like to know who prepared this plan because I see from it the International boundary line is wrong, and the dyke is depicted as being entirely on the American side of the boundary line. My recollection is that the boundary line is very irregular.

Senator MALBY: I think Mr. Warren prepared it. I have not the copies. I know that the International boundary line is not far north of the island, but the exact spot I could not tell you.

Mr. CLINTON: It would be a very important matter to know if the Commission recommended a permit.

Senator MALBY: It is intended to have the construction wholly in the American territory.

Messrs. Malby and Warren examine map with members of the Commission with reference to the location of the boundary line.

Mr. DAWLEY: We crossed the boundary line a little on the westerly end.

Mr. WARREN: The intention was to keep it wholly within the line.

Mr. CLINTON: In order to do that you have to make a fictitious line, not intentionally of course.

Mr. GIBBONS: Have you got the land on the Canadian side?

Mr. WARREN: No sir, not on the Canadian side.

Mr. GIBBONS: It is all Government land?

Senator MALBY: I am rather inclined to think that the drawer of the map, while of course the canal has got to be on a straight line, I am rather inclined to think that he undertook to place it far enough in to avoid the boundary line. It seems as though he had that in view.

Brig. Gen'l. ERNST: You made some reference to location. This here as laid down, the original location, is also on the boundary line.

Mr. WARREN: We crossed the international boundary line and we had to keep within the international boundary line. Our idea was to keep it in a fairly straight line.

Senator MALBY: Of course if there is any question about our getting over the boundary line we are as anxious as the commission to avoid that.

Mr. GIBBONS: I do not see where it is material.

Senator MALBY: In granting the application it might be stated that it did not authorize the construction of dykes or dams outside the American territory. If there was any objection.

Mr. GIBBONS: I do not see that it is going to be material at all. If it is not injurious to the canal in any way, I have no doubt the Dominion Government would be willing to give the concession.

Senator MALBY: Of course it is land under the water, and pretty swift water, and it cannot be of intrinsic value to anybody.

Mr. GIBBONS: It is a question about the diversion of this water whether it is going to have an injurious effect to the interest of others.

Mr. CLINTON: It seems to me before we do make a recommendation we should be able to state something definite.

Senator MALBY: Of course all the engineers reported, the utmost that any of the engineers would do, either our own or Canadian engineers, with reference to this other matter was to say in their judgment it would not affect anything. Of course you never can tell about those things until you do them. But their judgment at that time proved to be good and I suppose it would be a safe guide to follow.

Mr. CLINTON: I was meaning rather the location of the dyke. If we make a report on it it seems to me we ought to be as definite as possible in the report.

Senator MALBY: What suggestion have you to make about that?

Mr. GIBBONS: About 300 feet, is that definite?

Mr. COSTE: This is not from actual survey, Mr. Warren tells me. It is enlarged from the United States chart. If they run this line and simply ask for permission to build a dyke as shown on plan

Mr. CLINTON: That would do.

Mr. COSTE: It would take a day to run that line. Just give the bench marks to know where to start.

Mr. GIBBONS: It seems to me to be absolutely essential that we have a definite plan.

Senator MALBY: I suppose that map.

Mr. COSTE: It gives an idea of the project.

Senator MALBY: I supposed that it was taken from data which was regarded by our Government as being substantially correct.

Brig. Gen'l. ERNST: You see there is the difficulty here. That is simply an enlargement of this. You see what a very small scale that is.

Mr. DAWLEY: This island is a definite location. Then we have it quite within bounds.

Senator MALBY: From your tracing, the canal as laid down on the map there would cross the boundary?

Brig. Gen'l. ERNST: Yes. You see here is the boundary line

Mr. COSTE: The simple way will be to drive a post there and say, starting from that point, etc.

Mr. DAWLEY: We would be very willing to do that.

Mr. COSTE: And you can build the works as shown on plan. What is the flow?

Mr. WARREN: The flow is approximately 800,000 cubic feet.

Brig. Gen'l. ERNST: A minute?

Mr. WARREN: Yes.

Mr. COSTE: I think the flow must be more than that.

Mr. GIBBONS: It seems that what we want now is I think Mr. Dawley seems to understand that it is necessary that we should have a definite plan showing just exactly what you do want staked out. What we propose to do is to submit that to the engineer of our canal and ask whether there is any objection from the canal's standpoint, and if there is not it is possible and very likely that the desire of the Commission will be of course to assist you to develop your power. The spirit I believe of the Commission is to give its approval when it can do so without materially or injuriously affecting navigation. Send copies of your maps to our Secretary and I think instructions will be given that as soon as they are received they are to be submitted to the engineers of the canal and in the same way a complete copy will be sent to the American Section and General Ernst and the other members of the American Section will dispose of it as soon as possible. I would like to dispose of it.

Senator MALBY: We were in hopes that we might get it closed up at this time, but we appreciate the necessity of the delay. I want to make a suggestion. If upon the report of your engineer the objections made by him were not of a vital character or such as could be overcome by modification of our plans in any way we would like to be informed of them that we could make our plans conform so far as possible to these objections.

Mr. WARREN: Do you wish us to confine ourselves exactly to the international line?

Mr. GIBBONS: To my mind I do not think it is at all material.

Brig. Gen'l. ERNST: I did not think it was.

Mr. WARREN: Of course if you got the concession from the Canadian Government, I suppose from the Department of Marine and Fisheries, if they should grant the application subject to the approval of the Canadian Government that would mean if we did cross the boundary line it would be an entirely safe business that far.

Brig. Gen'l. ERNST: Suppose some accident should happen on the Canadian side and you got into a lawsuit.

Senator MALBY: I would not want to advise my clients to proceed in the matter if we did go upon Canadian territory in any respect whatever. I do not want them to proceed with this enterprise unless we have the legal right from the Canadian Government to proceed.

Senator MALBY: We are very much obliged to you for the courtesy which you have extended to us and will forward the desired information as soon as possible.

THIRD REPORT OF THE CANADIAN SECTION, 1906.

REPORT OF THE CANADIAN SECTION OF THE INTERNATIONAL WATERWAYS COMMISSION FOR 1906.

OTTAWA, CANADA, Dec. 31, 1906.

The Honourable the Minister of Public Works of the Dominion of Canada:—

SIR,—The Canadian members of the International Waterways Commission have the honour to submit the following report, with regard to the work of the commission during the year 1906:

Re NIAGARA FALLS.

In our report of April 25, 1906, we made the following recommendations with regard to the diversions from the Niagara river and on the Niagara peninsula:—

(*a*) In the opinion of this commission it would be a sacrilege to destroy the scenic effect of Niagara falls, unless and until the public needs are so imperative as to compel and justify the sacrifice.

(*b*) It is possible to preserve its beauty, yet permit the development on the Canadian side at the Niagara river itself and elsewhere by diversions on the Niagara peninsula to Lake Ontario, of water for power purposes to the extent of not more than 36,000 cubic feet per second, exclusive of water required for domestic uses, and for the service of locks in navigation canals.

(*c*) It is likewise possible to allow the diversion of waters for power purposes on the American side to the extent of 18,500 cubic feet per second, exclusive of the amount required for domestic uses, without serious injury to the scenic aspect of the falls.

(*d*) Your commission are of the opinion, therefore, that for the present the diversions should be limited to the quantities mentioned in sub-sections (*b*) and (*c*.)

(*e*) This would give an apparent advantage to the Canadian interests, but, as the diversion is not of serious injury to the falls does not materially affect the interests of navigation, it is more than counterbalanced by the complete diversion of 10,000 cubic feet by way of Chicago drainage canal to the Mississippi river.

Later on, the joint commission in the report of May 3, 1906, expressed the following views and recommendations:—

1. In the opinion of the commission, it would be a sacrilege to destroy the scenic effect of Niagara falls.

2. While the commission is not fully agreed as to the effect of diversions of water from Niagara falls, all are of the opinion that more than 36,000 cubic feet per second on the Canadian side of the Niagara river or on the Niagara peninsula, and 18,500 cubic feet per second on the American side of the Niagara river, including diversions for power purposes on the Erie canal, cannot be diverted without injury to Niagara falls as a whole.

3. The commission, therefore, recommends that such diversions, exclusive of water required for domestic use or the service of locks in navigation canals, be limited on the Canadian side to 36,000 cubic feet per second, and on the United States side to 18,500 cubic feet per second (and in addition thereto, a diversion for sanitary purposes not to exceed 10,000 cubic feet per second, be authorized for the Chicago drainage canal), and that a treaty or legislation be had, limiting these diversions to the quantities mentioned.

The effect of the diversion of water by the Chicago drainage canal upon the general navigation interests of the Great Lakes system will be considered in a separate report.

The Canadian section, while assenting to the above conclusions, did so upon the understanding that in connection therewith should be expressed their view that any treaty or arrangement as to the preservation of Niagara falls, should be limited to a term of twenty-five years, and should also establish the principles applicable to all diversions or uses of waters adjacent to the international boundary, and of all streams which flow across the boundary.

The following principles are suggested:—

1. In all navigable waters the use for navigation purposes is of primary and paramount right. The Great Lakes system on the boundary between the United States and Canada, and finding its outlet by the St. Lawrence to the sea, should be maintained in its integrity.

2. Permanent or complete diversions of navigable waters or their tributary streams, should only be permitted for domestic purposes and for the use of locks in navigation canals.

3. Diversions can be permitted of a temporary character, where the water is taken and returned, when such diversions do not interfere in any way with the interests of navigation. In such cases each country is to have a right to diversion in equal quantities.

4. No obstruction or diversion shall be permitted in or upon any navigable water crossing the boundary or in or from streams tributary thereto, which would injuriously affect navigation in either country.

5. Each country shall have the right of diversion for irrigation or extraordinary purposes in equal quantities of the waters of non-navigable streams crossing the international boundary.

6. A permanent joint commission can deal much more satisfactorily with the settlement of all disputes arising as to the application of these principles, and should be appointed.

'The American members are of opinion that the enunciation of principles to govern the making of a general treaty is not within the scope of their functions; moreover the jurisdiction of the American members is restricted to the Great Lakes system.'

The quantity allowed to be diverted on the Canadian side was fixed at an amount, which, it was assumed, would allow the companies on that side to complete the works which they had under construction, as follows:—

	Cubic Feet.
Canadian Niagara Power Company	9,500
Ontario Power Company	12,000
Electrical Development Company	11,200
Niagara Falls Park Railway Company	1,500
Welland Canal, or its tenants (in addition to lock service)	1,800
Total	36,000

Producing about 425,000 horse-power. Amount allowed, 36,000 cubic feet.

On the American side the works in operation, or in course of construction, were as follows:—

	Cubic feet.
Niagara Falls Hydraulic and Manufacturing Company	9,500
Niagara Falls Power Company	8,600
Erie Canal, or its tenants (in addition to lock service)	400
Total	18,500

Amount allowed, 18,500 cubic feet.

The matter was a subject of special legislation in the United States Congress, and what is known as the Burton Bill was passed and received the approval of the President in the following form:—

'A bill for the control and regulation of the waters of Niagars river, for the preservation of Niagara falls, and for other purposes.'

'Be it enacted by the Senate and House of Representatives of the United States of America, in Congress, assembled.

'That the diversion of water from Niagara river or its tributaries, in the state of New York, is hereby prohibited, except with the consent of the Secretary of War as hereinafter authorized in section two of this Act: Provided, That this prohibition shall not be interpreted as forbidding the diversion of the waters of the Great Lakes or of Niagara river for sanitary or domestic purposes, or for navigation, the amount of which may be fixed from time to time by the Congress of the United Sattes or by the Seeretary of War of the United States, under its diecstion.

'Sec. 2. That the Seeretary of War is hereby authorized to grant permits for the diversion of water in the United States from said Niagara river or its tributaries for the creation of power to individuals, companies or corporations which are now actually producing power from the waters of said river, or its tributaries, in the state of New York, or from the Erie Canal; also permits for the transmission of power from the Dominion of Canada into the United States, to companies legally authorized therefor, both for diversion and transmission, as hereinafter stated, but permits for diversion shall be issued only to the individuals, companies or corporations as aforesaid, and only to the amount now actually in use: Provided, that the said secretary, subject to the provisions of section five of this Act, is hereby authorized to grant revocable permits, from time to time, to such individuals, companies or corporations, or their assigns, for the diversion of additional amounts of water from the said river or its tributaries to such amount, if any, as in connection with the amount diverted on the Canadian side, shall not injure or interfere with the navigable capacity of said river, or its integrity and proper volume as a boundary stream, or the scenic grandeur of Giagara falls; and that the quantity of electrical power which may, by permits, be allowed to be transmitted from the Dominion of Canada into the United States, shall be one hundred and sixty thousand horse-power: Provided further, that the said secretary, subject to the provisions of section five of this Act, may issue revocable permits for the transmission of electrical power so generated in Canada, but in no event shall the amount included in such permits, together with the said one hundred and sixty thousand horse-power, and the amount generated and used in Canada, exceed three hundred and fifty thousand horse-power: Provided always, that the provisions herein permitting divisions and fixing the aggregate horse-power herein permitted to be transmitted into the United States, as aforesaid, are intended as a limitation on the authority of the Secretary of War, and shall in no wise be construed as a direction to said secretary to issue permits, and the

Secretary of War shall make regulations preventing or limiting the diversion of water and the transmission of electrical power as herein stated:and the permits for the transmission of electrical power issued by the Secretary of War may specify the persons, companies or corporations by whom the same shall be transmitted, and the persons, companies or corporations to whom the same shall be delivered.

'Sec. 3. That any person, company, or corporation diverting water from the said Niagara river or its tributaries or transmitting electrical power into the United States from Canada, except as herein stated, or violating any of the provisions of this Act, shall be deemed guilty of a misdemeanour, and on conviction shall be punished by a fine not exceeding two thousand five hundred dollars nor less than five hundred dollars, or by imprisonment (in the case of a natural person) not exceeding one year, or by both such punishments, in the discretion of the court. And, further the removal of any structures or parts of structures erected in violation of this Act, or any construction incidental to or used for such diversion of water or transmission of water or transmission of power as is herein prohibited, may be enforced by the order of any circuit court exercising jurisdiction in any district in which the same may be located, and proper proceedings, to this end, may be instituted under the direction of the Attorney General of the United States.

'Sec. 4. That the President of the United States is respectfully requested to open negotiations with the government of Great Britain for the purpose of effectually providing, by suitable treaty with said government for such regulation and control of the waters of Niagara river and its tributaries as will preserve the scenic grandeur of Niagara falls and of the rapids in said river.

'Sec. 5. That the provisions of this Act shall remain in force for three years from and after date of its passage, at the expiration of which time all permits granted hereunder by the Secretary of War shall terminate, unless sooner revoked, and the Secretary of War is heerby authorixed to revoke any or all permits granted by him by authority of this Act, and nothing herein contained shall be held to confirm, establish, or confer any rights heretofore claimed or exercised, in the diversion of water or the transmission of power.

'Sec. 6. That for accomplishing the purposes detailed in this Act the sum of fifty thousand dollars, or so much thereof as may be necessary, is hereby appropriated from any moneys in the treasury not otherwise appropriated.

'Sec. 7. That the right to alter, amend or repeal this Act is hereby expressly reserved.'

It will be seen that this Bill is only a temporary measure and intended to control conditions at Niagara, pending the negotiation of a treaty.

In the meantime application has been made to the Secretary of War of the United States for the privilege of exporting into the United States, power, as follows:

The Ontario Power Company.....	90,000 h. p.
The Canadian Niagara Power Company.....	125,000 h. p.
The Electrical Development Company.....	62,000 h. p.

Final action has not as yet been taken, but in the meantime it has been recommended by the American section that permits be granted as follows:—

The Ontario Power Company.....	60,000 h. p.
The Canadian Niagara Power Company.....	60,000 h. p.
The Electrical Development Company.....	37,500 h. p.
The International Railway Company.....	2,500 h. p.

In the opinion of your commission, if any treaty be had with relation to the use of these waters, the proportions recommended and agreed upon by the joint commission should be adhered to.

The Ontario Power Company, through its ally, the Niagara Lockport and Ontario Company, has built transmission lines in New York State, in duplicate, and in branches, through a territory one hundred and fifty miles long and twenty miles wide at an expense of upwards of $4,000,000, and for several months has been delivering power at the extreme end of the line.

This company has not so far made any serious effort to supply the Ontario market.

Mr. Paul K. Cravath, representing the Niagara Lockport and Ontario Power Company, in his address before the Secretary of War at Washington, stated that his company had entered into a contract with the Ontario Power Company to take from them a minimum of 60,000 horse-power at the international boundary line, and had reserved the option to take increased power to the amount of 180,000 horse-power, which would be the total capacity of the Ontario Power Company's works.

This company has neglected the city of Buffalo, leaving that market to the Canadian Niagara Power Company, and has extended its lines to Rochester and Syracuse. They are at present developing something under 60,000 horse-power, and it is stated by Mr. Cravath that they have already existing closed contracts for 90,000 horse-power, all on the American side.

The Canadian Niagara Falls Power Company are in a position to develop at present about 55,000 horse-power, all of which will be supplied to customers in the neighbourhood of Niagara falls on the American side, and to the city of Buffalo and its contiguous outlying districts.

This corporation has not made any effort so far to supply the Canadian market.

The Electrical Development Company, which is more particularly a Canadian corporation, has built a transmission line to the city of Toronto. They have qualified themselves to produce about 50,000 horse-power in the immediate future.

This company is making strenuous efforts to have immediate permission to export to the United States, power to the extent of 53,000 horse-power.

In view of these conditions, and of the special advantages which will be created by a treaty arrangement, your commission would respectfully reiterate the views which they expressed in their report of the 25th of April, 1906, that your government, while fully recognizing the rights of these corporations, should so control the export of power from Canada as to protect public interests.

Your commissioners are of opinion that each of the companies, in their agreement with the Park Commissioners, stipulated that they would, 'whenever required, from the electricity or pneumatic power generated under this agreement, supply the same in Canada (to the extent of any quantity not less than one-half the quantity generated), at prices not to exceed the prices charged to cities, towns and consumers in the United States, at similar distances from the Falls of Niagara, for equal amounts of power and for similar uses.' They do not comply with the conditions of their agreement unless and until they have severally or jointly built transmission lines in Canada to an equal extent as in the United States.

Your commission is of opinion that it was of the spirit of the agreement if not the letter that the companies should themselves reach out to and supply the Canadian public, and that it is not a fair interpretation of the agreement that Canadian consumers should be expected to build transmission line to Niagara falls as a condition of receiving any benefit from this public utility.

Irrespective of any agreement, private corporations using the natural resources of Canada, should, in the opinion of your commission, be compelled to operate the same, so as to afford adequate service in the first place to the Canadian public, and export of power at Niagara should only be allowed to the extent of the surplus after the Canadian market has been fully supplied under reasonable conditions and at fair prices.

SESSIONAL PAPER No. 19a

THE DETROIT RIVER TUNNEL COMPANY.

The commission has considered the application of the Detroit River Tunnel Company for permission to tunnel the Detroit river. The regulations determined by the United States War Department were as follows:—

(*a*) That all operations shall be under the supervision and, so far as concerns the interests of navigation in the waters of the United States, under the control of the officer of the corps of engineers whose district includes the Detroit river; and who is hereinafter referred to as the district engineer. The Tunnel Company shall furnish such assistance and appliances as the district engineer shall require in supervising and inspecting the work.

(*b*) That the work of constructing the subaqueous portion of the tunnel shall begin at the American bank of the river, and proceed continuously toward the Canadian bank, in order that the working force may acquire experience and training at work where the water is shallowest and less used for navigation; thereby insuring the greatest rate of progress when operations approach the Canadian side and cross the path usually followed by vessels engaged in through traffic.

(*c*) That the Detroit River Tunnel Company may, in the prosecution of this work, use a pile platform of the general character described in its application, or, at its option, a floating platform of type to be approved by the district engineer. Whatever the character of platform used, its length, including all floating plant used in connection with it, shall at no time exceed 600 feet, measured transversely to the axis of the stream, and its width measured parallel to this axis, shall be not more than 300 feet.

(*d*) That due notification, in writing, shall be given to the district engineer of the beginning of dredging operations in the navigable waters of the United States, and that thereafter these dredging operations and the subsequent operations of tunnel extension and completion shall be pushed continuously, except when the river is obstructed by ice, and at a rate of not less than 2,000 cubic yards per day for the dredging, and ten feet per day of completed tunnel, the rate for the tunnel work to be figured from time to time of completion of the first section, 600 feet in length, of the erecting platform, floating or otherwise.

(*e*) That for the purpose of controlling and safeguarding navigation in the vicinity of the site of the proposed tunnel, the Detroit River Tunnel Company shall, at its own expense, furnish a fully-equipped tug of suitable size and power, to be constantly on duty at the site of the work, and, so far as the above purpose is concerned, under the exclusive control and direction of the district engineer. The Tunnel Company shall also maintain such lights as the district engineer shall require for properly marking every obstruction to navigation that may be introduced in connection with the work in progress.

These regulations were accepted by the Canadian Department of Marine and Fisheries, and the following resolution was adopted:—

'That the International Waterways Commission approve of the plans of the construction of a tunnel under the Detroit river, prepared by the Detroit River Tunnel Company, and submitted to the commission by the Chief of Engineers of the United States Army, under date of February 13, 1906, and to the Minister of Marine and Fisheries for Canada, under date of November 16, 1905, the construction to be carried on the American side under the regulations contained in the report of the Board of Engineers of the United States Army of date January 26, 1906, and that the same be carried on on the Canadian side under regulation to be fixed by the Minister of Public Works and the Minister of Marine and Fisheries.'

The plan and mode of construction having been submitted to the Minister of Public Works, were approved by the Governor General in Council on July 12, 1906, copy of the minutes are appended, marked 'A.'

The tunnel is in course of construction, and it is expected will be completed within two years.

THE USES AND CONDITIONS OF THE WATERS OF ST. MARYS RIVER AT SAULT STE. MARIE.

This question was disposed of by an unanimous report of the joint commission, dated May 3, 1906, in which the following recommendations were agreed upon:—

1. That no permits shall be granted for the use of the waters of St. Marys river, or for the erection of structures in, under or over, or the occupation in any manner of the said waters, until plans have been submitted to the commission for its investigation and recommendation; and the use of the waters under such permits, shall not be allowed, except upon compliance with the rules hereinafter recommended.

2. The commission further recommends that no grants, permits, or concessions should be made, which directly or by operation of law may, in any manner affect the right of the United States or Canada to control the bed of the St. Marys river below high-water mark, and especially that none should be made which legally or equitably may be the means of adding to the expense of acquiring lands or rights for the purpose of making improvements in aid of navigation, or which may give an equitable right to compensation in case of the removal of structures in said river.

3. That steps be taken to increase the lockage facilities at the Sault Ste. Marie without unnecessary delay.

4. That the Governments of the United and Canada reserve all water necessary for navigation purposes, at present or in the future, and the surplus shall be divided equally between the two countries for power purposes.

5. As the Commission regards the interests of the United States and Canada in the preservation of the lake levels, and in the improvement of the channels and the conservation of the water supply for purposes of navigation as identical and as incapable of efficient protection without joint and harmonious action on the part of the two governments, it recommends that the rules hereinafter set forth be adopted, and that a joint commission be created to supervise their enforcement or that such powers be vested in the existing International Waterways Commission, subject to such restrictions and reservations as may be deemed advisable.

The Secretary of War, in his annual report, makes reference to these recommendations as follows:—

'These recommendations received my approval. Embodied in the report were a series of rules and regulations to govern the use of water at the Sault. As the enforcement of these rules involves the creation of a permanent international commission, they have not, as yet, been put in force. It is to be presumed that provision for a permanent commission will be arranged in a treaty. The report was approved by me, and was referred to the Secretary of State.'

A letter from the Acting Secretary of State to the Secretary of War, relating to the same subject, is hereto appended, and marked 'B.'

THE MASSENA WATER POWER COMPANY.

This question was brought before the Commission by a letter from the Secretary of the Department of Public Works of Canada enclosing letter from the Calvin Company, Limited, to the Honourable the Minister of Public Works, protesting against construction of a dam, which is in contemplation by the

Massena Power Company, in the channel of the St. Lawrence river, south of the Long Sault island.

As the proposed works would be entirely in the United States territory, construction could not, in any case, be permitted without the concurrence of the War Department of the United States, but as no application had been made to that department or this commission, no action was thought necessary.

THE PRESERVATION OF THE CANADIAN SHORE ALONG THE DETROIT RIVER.

At the meeting, held by the commission on May 3, 1906, at Buffalo, N.Y., Mr. Louis Coste, one of the Canadian commissioners, brought up the question of the injury done to the banks of the connecting channels of the Great Lakes by reason of the speed of the boats traversing those channels.

A petition from the reeve of the township of Malden, in the county of Essex, to the International Waterways Commission, copy of which is appended, marked 'C', was presented to the commission. An investigation took place, and the commission decided that every effort should made to assist the riparian owners in the protection of their property, and an appeal was made to the engineer officer in charge of the improvements on the river, with the result that provision was made in a recent contract, under his charge, for protecting the Canadian shores by depositing boulders along that shore.

The Canadian section of the commission, in their investigation, reached the conclusion that the removal of large quantities of sand from the Canadian shore by sand suckers, is one of the causes of the cutting away of the bank, and they strongly recommend that steps be taken to prevent this practice.

THE APPLICATION OF THE MINNESOTA CANAL AND POWER COMPANY.

The Minnesota Canal and Power Company, a corporation organized under the laws of Minnesota, proposed to construct reservoirs in the Birch Lake basin in Minnesota, and to conduct the water to be stored therein by artificial and natural channels southward to Duluth. The natural drainage of the Birch Lake basin is northward into the Rainy river, Lake of the Woods, Winnipeg lake, and finally into the Hudson bay, the water thus forming a part of the international boundary, and finally entering territory which is exclusively Canadian.

At the request of the British Ambassador, that action be deferred until the matter be investigated by the International Waterways Commission, the United States Department of the Interior suspended action, and the subject was finally referred to the commission in compliance with a request contained in a letter, dated May 14, 1906, from the United States Secretary of State to the Secretary of War. The commission tendered a joint report to the two governments, dated November 15, 1906, in which are the following recommendations, viz.:—

1. The commission would, therefore, recommend that the permit applied for be not granted without the concurrence of the Canadian government.

2. As questions involving the same principles and difficulties, liable to create friction, hostile feelings, and reprisals, are liable to arise between the two countries, affecting waters on or crossing the boundary line, the commission would recommend that a treaty be entered into which shall settle the rules and principles upon which all such questions may be peaceably and satisfactorily determined as they arise.

3. The commission would recommend that any treaty which may be entered into should define the uses to which international waters may be put

by either country without the necessity of adjustment in each instance, and would respectfully suggest that such uses should be declared to be:

(*a*) Use for necessary domestic and sanitary purposes.

(*b*) Service of locks used for navigation purposes.

(*c*) The right to navigate.

4. The commission would also respectfully suggest that the treaty should prohibit the permanent diversion of navigable streams which cross the international boundary or which form a part thereof, except upon adjustment of the rights of all parties concerned by a permanent commission, and with its consent.

The Secretary of War, in his report, says, 'I still have this matter under advisement, and expect to render my decision at an early date.'

THE CHICAGO DRAINAGE CANAL.

The diversion by the Chicago Drainage Canal of a large volume of water otherwise tributary to the Great Lakes system, has been in consideration by your commission, and a number of public meetings have been held at which the various interests have been represented.

The commission hope at an early date to be able to agree upon conclusions and recommendations in regard to this important subject, and submit the same in a special report.

THE APPLICATION OF MR. SMITH L. DAWLEY FOR PERMISSION TO DEVELOP POWER AT LONG SAULT RAPIDS.

In May last, application (copy appended, marked 'D'), was made to the Secretary of War of the United States, by Mr. Smith L. Dawley, of Ogdensburg, for permission to construct dykes, retaining wall and such other structures as may be necessary for the development of a water-power in connection with navigable approaches to a summer resort, on the United States side of the Long Sault rapids in the St. Lawrance river.

The commission have been unable to obtain from the promoters the information necessary to enable them to form an opinion upon the effect which the granting of this charter would have upon navigation interests, and in the meantime action has been deferred.

THE QUESTION OF A TUNNEL AND INLET PIER FOR THE BUFFALO WATERWORKS.

At a meeting of the commission, held on June 26, 1906, at Buffalo, N.Y., Col. F. G. Ward, Commissioner of Public Works, of the City of Buffalo, appeared before the commission and stated that the proposed location of the inlet pier for the new waterworks tunnel for the city was in Canadian waters. He further stated that he had requested the American authorities to make application to the Canadian government to be authorized to erect the inlet pier in this location, copy of said application to the Governor General in Council and to the Minister of Public Works appended, marked 'E' and 'F' respectively.

Part of the proposed works being in Canadian waters, the matter was reported upon by Col. H. M. Adams, Corps of Engineers, United States Army, copy of said report appended, marked 'G'.

Application was also made by the city of Buffalo, to Honourable Wm. H Taft, Secretary of War, copy of said application appended, marked 'H'.

The commission having satisfied themselves that the proposed undertaking would not interfere with navigation, passed the following resolution:—

Resolved, That in the opinion of the International Waterways Commission, the tunnel and inlet pier, proposed to be constructed in Lake Erie, by the city of Buffalo for the purpose of furnishing a pure water supply to the city, can be built without injury to navigation or other public interests, and it is recommended that permits for the construction of these works be granted with the proviso that the inlet pier be kept properly lighted at night at the expense of the city.

(Signed) GEO. C. GIBBONS,
Chairman, Canadian Section.

(Signed) O. H. ERNST,
Chairman, American Section.

Attest:
THOMAS CÔTÉ,
Sec. Canadian Section.

The Canadian government endorsed the above resolution by a minute of the Privy Council, dated July 20, 1906, copy of which is appended, marked 'I.'

NAVIGATION AND POWER DEVELOPMENT ON THE RICHELIEU RIVER.

An application (copy appended, marked 'J'), which was made by the International Development Company for permission to construct regulating works in Richelieu river in connection with a combined navigation and power project, was referred by the Secretary of War of the United States to the commission, by which it was considered at their meeting at Buffalo, November 13 and 15.

The joint commission made a full report upon this subject, which has been submitted to both governments, from which the following is an extract:—

'As Lake Champlain is wholly within the territory of the United States, and the proposed works are wholly within Canadian territory, the international questions raised are of some moment. It is, in our opinion, not desirable that either nation should obstruct the natural flow of streams crossing the international boundary to the injury of the public or private rights in the other. It is manifest, therefore, that the applicants should furnish conclusive evidence that private rights in the States of New York and Vermont, adjoining Lake Champlain, will not be injuriously affected by the alteration of the lake level as proposed, and that as the Secretary of War of the United States has control of the interests of navigation on Lake Champlain, the said work should not be undertaken without his permission, and should be operated under such regulations as he may direct, with a view to the maintenance of the level of the said lake, as the interests of navigation thereon require. It would be possible to plan works adapted to the conditions, and in our opinion such works should be permitted, provided they do not interfere with private interests in the United States, and meet with the approval of the Secretary of War, as suggested. We respectfully submit that in any treaty to be had between the two nations in relation to the use of international waters, the principles above suggested should have consideration. We would further suggest that the applicants' Canadian Act of incorporation should be amended so as to provide that the maintenance of the works sought to be erected shall be conditional at all times upon compliance with all regulations imposed by the Secretary of War of the United States of America, from time to time, for the preservation of the levels of Lake Champlain.

THE IRRIGATION QUESTION.

The question of the use of the waters of St. Marys and Milk rivers, in the state of Montana, and the province of Alberta, was brought before the commission, but no action could be taken in the matter, since the American section did not consider that it lay within their powers to deal with the questions.

It may be of interest, however, to give here a brief statement of the salient points of the question. St. Marys and Milk rivers both rise in Montana, a few miles south of the boundary line (49th parallel), the former in the Rocky mountains, the latter, farther east, from the eastern slopes of the foot-hills. Both rivers flow north into Canada, but Milk river, after a course of over one hundred miles, recrosses the boundary line and finally falls into the Missouri river.

On both sides of the boundary line, in the region which may be reached by irrigation canals, from these rivers, is a large tract of semi-arid country, of little use in its natural condition, but capable of vast development when a regular supply of water is assured. It is probable that the whole water supply of the two rivers might be put to beneficial use on either side of the boundary line. Of the two rivers, the St. Marys' is the more valuable for irrigation purposes, since it is the larger river in average flow, and also has a more constant supply, from the melting of snow at its mountain sources, during the hot months.

In the early days of irrigation in the Western States, the waters of streams were treated by riparian proprietors as property appertaining to their lands, which they could divert at will, without reference to the rights of other riparian owners. As the water used in irrigation is in great part, if not altogether, absorbed by growing vegetation, or dispersed by evaporation, little is returned to the river below, and the common law rights of the lower proprietors, to the natural flow through their lands, were impaired.

This was of little consequence when irrigating works were limited to the supply of a few cultivated acres, but when the advantages of irrigation came to be more fully recognized, and developments became more extensive, conflicts of interests multiplied, and the necessity of regulation of diversions by law became evident.

Laws for this purpose have been adopted by the several states in which irrigation is employed. These laws vary in different states, and it is not the intention here to discuss the details of the differences between different laws. The general principle behind them all is however, the rights of the first diverter of water to his beneficial use; assertion of intention to divert is required by record in the registry office, by notice posted at the place of intended diversion, by newspaper advertisement, or the like. Difficulties arise, when there is no authority to apportion the water, from excessive appropriation by one owner to the detriment of the rest, and from the fact that records made against the same stream in different districts are not accessible; the intending irrigator has difficulty in ascertaining either what appropriations have been made which will lessen the flow to him, or those which have been made below him, and which he should respect.

It was the good fortune of Canada to be able to deal with these questions before they became complicated by vested private interests. In 1894 an Act of Parliament was passed by which the right of use of waters available for irrigation was vested in the Crown, and provision was made for apportionment of the waters under regulations to be made by the Minister of the Interior. Surveys were made by the Dominion government to ascertain the most favourable locations for irrigation works, in order that the water might be used to the best advantage. Several irrigation projects have been developed under this policy, of which the Alberta Railway and Irrigation Company, whose canals connect with both the St. Marys and the Milk river, is particularly concerned in the present question.

In 1901 an Act of Congress was passed having similar objects. Under this Act, a fund constituted by the sales of public lands in the west is to be used for the construction of irrigation works, where the same will be profitable. The administration of the fund is in the hands of the Reclamation Branch of the United States Geological Survey.

While the two laws are alike in establishing federal control of the use of water, they differ in that, under the American law the construction is carried on by public money, the cost being chargeable against the lands benefited. Under the Canadian Act construction is carried on by individuals or companies, but strictly under control of the government which controls the general plan of the works and prescribes the amount of water which may be diverted at a given place, the quantity which may be used for watering a given acreage, and the price which may be charged to the settler for it. The company is compensated for its work by an allowance on the price of the land sold.

The Alberta Railway and Irrigation Company, organized in 1898, has an extensive canal system from St. Marys river. They have also a canal by which water may be taken from Milk river, but this has not yet been put in operation.

One of the projects of the United States Reclamation Service is the diversion of water from St. Marys river to irrigate land chiefly situated in the lower Milk river region. The canal for this purpose may either discharge into Milk river, whose natural channel would be utilized to carry the water through Canada to where it is to be used, or by a more southern route.

Fears have been expressed that this diversion may prejudicially affect the present settlements on the Alberta Railway and Irrigation Company's lands in Canada, or the future development, which may, in the natural course of things, be expected in that region, and the matter has been the subject from time to time of diplomatic exchanges between Ottawa and Washington, but no basis of agreement has yet been reached.

The Secretary of War, in his report for the past year, referring to the question of jurisdiction, says:—

'Under the law of Congress creating the commission, its jurisdiction is limited to the waters whose natural outlet is by the River St. Lawrence to the Atlantic ocean. The Canadian government has, from the beginning, desired that the commission should consider all questions which may arise concerning the international waters from the Atlantic to the Pacific. To enable the American members to do this, further legislation by Congress is necessary. It would seem proper to comply with the wishes of the Canadian government in this respect.'

If the jurisdiction of this commission is extended as suggested, the matter can be taken up and no doubt some equitable plan of division of these waters can be suggested under the direction of the joint commission.

THE LAKE ERIE BOUNDARY QUESTION.

On August 21, last, Captain Dunn, of the Canadian Fisheries cruiser *Vigilant* seized, as being in Canadian waters, certain nets, the property of the Keystone Fish Company, of Erie, Pa., which had been set in Lake Erie to the north-northwest of Erie. Copy of the departmental instructions under which Captain Dunn made the seizure is appended, marked 'K.'

It was claimed by the Keystone Fish Company that the nets were in American waters, and protest was made to the United States government against the action of Captain Dunn.

The condition seems to be complicated by differences in the charts as regards the position of the boundary line.

The question was referred to the International Waterways Commission to ascertain whether the American and Canadian charts of the locality agree as to the distance which should be logged from the gas buoys at Erie to the boundary line. The correspondence relating to the complaint of the Keystone Fish Company and the reference to the commission will be found appended, marked L.' The subject is about to be dealt with in a special report of this commission which will be submitted in due course.

THE QUESTION OF CONTROLLING WORKS AT THE OUTLET OF LAKE ERIE.

This question, which was especially referred to the commission by the Act of Congress of 1902, will be taken up by the commission at an early date.

THE DEATH OF MR. GEORGE Y. WISNER.

Early in July, the commission lost one of its most distinguished members in the person of Mr. George Y. Wisner, hydraulic engineer of the city of Detroit, Mich. At a meeting held in Toronto on July 24, the appointment of Mr. E. E. Haskell, of Detroit, by the United States government was announced and the new commissioner presented. At that meeting it was moved by Mr. Gibbons chairman of the Canadian section, seconded by Mr. Clinton and

Resolved, That the members of the International Waterways Commission have heard with profound regret of the decease of their colleague, George Y. Wisner, Esq., on July 3, at Detroit, Michigan. In the death of this eminent engineer the commission has lost an able adviser and valued associate. Upon the great experience and acquirements of Mr. Wisner the commission always felt it could rely; his fair-mindedness it has never doubted, and his devotion to his duties has ever assured the full and able performance of his duties as a commissioner. To his widow and family we extend our most sincere sympathy.

That this resolution be inscribed on the minutes and a copy be forwarded to Mrs. Wisner.

CONCLUSIONS.

It will be seen that the joint commission have made recommendations leading up to the formation of a treaty of the most important character, and one which will establish for the first time general principles governing the use and diversion of international and boundary waters.

1. The report with regard to the Minnesota diversion establishes the principle that there should be no permanent diversion of navigable streams which cross the international boundary or which form a part thereof, except upon adjustment of the rights of all parties concerned by a permanent commission and with its consent, save:

(*a*) Use for necessary domestic and sanitary purposes.

(*b*) Service of locks used for navigation purposes.

(*c*) The right to navigate.

2. The report on the Richelieu river application establishes the principle that neither country should allow any obstruction in the waters of streams which cross the international boundary which would interfere with the natural course of such waters to the injury of public or private rights in the other country.

3. Where temporary diversions of the surplus water can be permitted as at Sault Ste. Marie, such diversion should be permitted in like quantity to each country, under the supervision of a joint commission.

4. The position at Niagara falls has been dealt with having regard to the exceptional circumstances there existing and taking into consideration the large permanent diversion by way of the Chicago drainage canal.

5. Other important reports will be submitted in the near future, all leading up to the permanent settlement of questions, which unadjusted would be fruitful sources of irritation.

Your commission desire again, as in their former report, to acknowledge the fair spirit in which all the members of the American section of the commission deal with international questions.

Respectfully submitted,

GEO. C. GIBBONS,
Chairman, Canadian Section.

W. F. KING,
Member, Canadian Section.

LOUIS COSTE,
Member, Canadian Section.

THOMAS CÔTÉ,
Secretary, Canadian Section.

APPENDIX 'A'.

EXTRACT from a report of the Committee of the Privy Council, approved by the Governor General on July 12, 1906.

On a report, dated June 29, 1906, from the Minister of Public Works, submitting that by the Act 51 Victoria, chapter 93 (1888), the Canada and Michigan Tunnel Company was incorporated, having powers thereby conferred for the building of a tunnel under the Detroit river for railway purposes, from some point at or near the town of Windsor or the town of Sandwich, towards the city of Detroit, and by the 35th section of this Act it was provided as follows:—

'35. The Company shall not commence the said tunnel or any work thereto appertaining until it has submitted to the Governor in Council plans of such tunnel and of all the intended works thereunto appertaining, nor until such plans and the site of such tunnel have been approved by the Governor in Council, and such conditions as he thinks fit for the public good to impose; nor shall any such plan be altered, or any deviation therefrom allowed, except by the permission of the Governor in Council, and upon such conditions as he imposes.'

That by the Act 58-59 Victoria, chapter 71 (1895), the name of the company was changed to the 'Canada and Michigan Bridge and Tunnel Company,' and the undertaking of the company was declared to be a work for the general advantage of Canada.

That by the Act 4-5 Edward VII., chapter 69 (1905), the construction of the tunnel or tunnels authorized by the Acts relating to the company were to be commenced within three years and completed within ten years from the passing of the Act.

That the company, pursuant of the powers contained in said firstly mentioned Act, amalgamated with the Michigan and Canada Bridge Tunnel Company, and formed a new corporation under the name of the 'Detroit River Tunnel Company,' and the agreement of amalgamation was duly filed in the

office of the Secretary of State of Canada, on August 23, 1905, notice of the amalgamation, the location of the office in Canada, and the name of the corporation was duly published in the *Canada Gazette*.

The Minister states that on March 3, 1906, the Detroit River Tunnel Company has submitted for approval plans of the tunnel as proposed and of the site thereof, the said tunnel starting from a point in the city of Windsor towards the city of Detroit.

That similar plans for the construction of the said tunnel have been approved of by the Secretary of War for the United States, so far as the said tunnel is within the jurisdiction of the United States (copy of instrument dated April 9, 1906, is submitted, giving permission for the construction and maintenance of said tunnel).

That the Chief Engineer of the Department of Public Works has reported to the effect that the work is well located, that the site is acceptable, and that the general design for the construction is satisfactory.

The Minister, in view of the foregoing, recommends that authority be given for the approval of the plans of tunnel and of site above-mentioned, subject to the following conditions:—

That all operations shall be under the supervision and so far as concerns the interests of navigation in the waters of the Dominion of Canada, under the control of an officer to be appointed by the Department of Public Works, who is hereinafter referred to as engineer in charge, the tunnel company shall furnish such assistance and appliances as said engineer in charge shall require in supervising and inspecting the work.

That said tunnel company may, in the prosecution of this work, use a pile platform of the general character described in its application, or, at its option, a floating platform of type to be approved by the said engineer in charge. Whatever the character of platform used, its length, including all floating plant used in connection with it, shall at no time exceed six hundred (600) feet, measured transversely to the axis of the stream, and its width measure parallel to this axis shall not be more than three hundred (300) feet.

That due notification, in writing, shall be given said engineer in charge of the beginning of dredging operations in the navigable waters of the Dominion of Canada, and that thereafter these dredging operations and the subsequent operations of tunnel extension and completion shall be pushed continuously, except when the river is obstructed by ice, and that the rate of not less than two thousand (2,000) cubic yards per day for the dredging, and ten (10) feet per day of completed tunnel, the rate for the tunnel work to be figured from the time of completion of the first section, six hundred (600) feet in length, of the erecting platform, floating or otherwise.

That for the purpose of controlling and safeguarding navigation in the vicinity of the site of the proposed tunnel, said tunnel company shall at its own expense, furnish a fully equipped tug of suitable size and power to be constantly on duty at the site of the work, and so far as the above purpose is concerned either under the exclusive control and direction of the engineer in charge to be appointed by the Department of Public Works of Canada, or under the joint control of this engineer and the district engineer to be appointed by the government of the United States. Said tunnel company shall also maintain such lights as such engineer in charge shall require for properly marking every obstruction to navigation that may be introduced in connection with the working in progress.

That the engineer in charge appointed by the Department of Public Works of Canada will be given free access to each and every part of the work during its construction, whether such part or portion of the work be in the United States or Canadian waters.

That consent be given to the taking possession by the company of so much public beach or lands covered with water or other property indicated on the said plans, as belongs to the Crown, and as may be necessary for the purpose of constructing and completing the said tunnel and for the convenient use of the same.

The committee submit the same for approval.

(Sgd.) JOHN J. McGEE,
Clerk of the Privy Council.

APPENDIX 'B.'

DEPARTMENT OF STATE, WASHINGTON,
July 17, 1906.

The Honourable
The Secretary of War.

SIR,—I have the honour to acknowledge the receipt of your report on the conditions existing at the Sault Ste. Marie, dated May 3, 1906, and signed by the American and Canadian members jointly of the International Waterways Commission organized in accordance with the provisions of section 4 of the River and Harbour Act, approved June 13, 1902, which report under date of May 14 last was endorsed with your approval so far as the War Department is concerned, and referred to the Secretary of State with a request that it be forwarded to the President as a basis for negotiations looking to the adoption of a treaty carrying into effect the recommendations of the commission.

As the proposed negotiations seem likely to involve the consideration of several of the other questions now pending before this commission, a preliminary list of which appears in the report of the American members of the commission addressed to you on December 1, 1905, and printed as Appendix 'F' of your annual report for the year 1905, it probably would be advantageous to await the reports of the commissioners on these questions, if such reports may be expected before initiating the negotiations on this question with the British Ambassador, in order that the whole subject may be dealt with comprehensively.

The considerations of these questions would naturally be associated with the proposed Niagara river negotiations, for which provision is made in the Act of Congress, approved on June 29, 1906. It will be observed that this Act fixed a limited period for carrying the negotiations on the Niagara river question to a conclusion. It is hoped, therefore, that any further recommendations from the commission, or the American members of the commission, with respect to these associated questions, which will require for their enforcement joint or concurrent action by the two governments under a treaty agreement, may be submitted by the commissioners as promptly as possible.

Inasmuch as the use of these waters is at present subject to War Department regulations, and apparently some of the recommendations of this report can be carried into effect on the American side of the boundary by executive action under existing laws, without treaty stipulations, it seems desirable that the report should be returned to you, pending the initiation of the proposed negotiations, in order that meanwhile the negotiations referred to may be adopted and enforced without waiting for concurrent action on the Canadian side, if that course seems desirable to you.

I therefore return herewith the original report, retaining a copy of it for the use of this department.

In transmitting this report, I desire to make a matter of record in connection with it, the fact that there is now pending an action brought by the United States against the Chandler-Dunbar Company, one of the power companies located on the American side of the Sault Ste. Marie, which involves some of the questions dealt with in this report, with respect to which the commissioners have stated their conclusions on the basis of the decision of the lower court in this case, which was against the contentions of the United States. I am advised by the Solicitor General of the United States, to whose attention this has been called, that an appeal is now pending from this decision, and if the United States succeeds on such an appeal and the decision is reversed, the conclusions of the commissioners based on the decision below, will require revision. This, however, I understand relates only to the title to land under water and to certain lands on the American side of the boundary, and apparently does not diminish the value of the recommendations above referred to.

I have the honour to be, sir,

Your obedient servant,

(Sgd.) ROBERT BACON,

Acting Secretary.

APPENDIX 'C.'

To the Members of the International Waterways Commission.

GENTLEMEN,—The Reeve and Council of the township of Malden, in the county of Essex, province of Ontario, Canada, respectfully call your attention to the serious damage which the property of riparian owners and the township road, along the Detroit river, have suffered within the last five or six years.

Your petitioners believe that the enlargement and deepening of the waterway or channel made for the purposes of commerce, and the building and operating of larger and faster boats consequent thereto, has been the cause of the damage.

The township has been put to considerable expense in attempting to remedy the evil, and is unable to expend any more or cope properly with the trouble and protect the banks of the river, and the council humbly asks your honourable commission to investigate the matter, with the view of obtaining the necessary assistance from the two governments who have authorized the expenditure for deepening the river and bringing the larger boats nearer to the shore and throwing their swell and wash strongly against the banks.

On behalf of the council of the township of Malden,

(Sgd.) ROBERT ATKEN,

Reeve.

(Sgd.) JAMES HOMER,

Clerk.

APPENDIX 'D.'

To the Honourable W. H. Taft,

Secretary of War, Washington, D.C.

Whereas there exists on Long Sault island in the town of Messena, St. Lawrence county, New York, certain conditions favourable to the creation of an attractive summer resort, with navigable approaches thereto and the development of a water-power entirely in that portion of the St. Lawrence river that is within the United States.

Therefore, application is hereby made to the Secretary of War for permission to construct dykes, retaining walls and such other structures as may be necessary, to carry out the above proposition. We refer to a marked chart of a section of the St. Lawrence river accompanying this application and which is part of the same. The dyke will begin at a point about 36 rods westerly from the east end of the above named island and on the northerly side of same, and at a point in the shallow water about 300 feet out, or northerly from high-water mark on the shore of said island. Running thence easterly along said shore, keeping the wall out from same about the distance of 300 feet, northerly from the projecting points of the said island to a dam to be constructed at or near, but not beyond the point marked for it on the above-mentioned chart.

The wall at the starting point will rise not more than four feet above high-water mark and will extend level at same height to the dam. The above-mentioned dam shall be constructed with a spill-way or provision for overflow in case of high water. It is the opinion of competent engineers who have examined the proposition, that it will not in any way divert water from the channel, but will rather tend to throw more water into the channel and thus will be a benefit to navigation in that rather shallow portion of the St. Lawrence river.

Respectfully submitted,

(Sgd.) SMITH L. DAWLEY.

Ogdensburg, N.Y., May 28, 1906.

APPENDIX 'E.'

BUFFALO, July 9, 1906.

To the Honourable

The Minister of Public Works.

Ottawa, Canada.

SIR,—The city of Buffalo desires to locate its new intake pier and tunnel in Lake Erie, a portion of which proposed location is in Canadian waters.

I have to-day made application to His Excellency, the Governor General of Canada, through the Honourable the Secretary of State at Washington, D.C., for permission to locate this tunnel as shown on the accompanying maps. I inclose herewith, for your information, a copy of the application to the Governor General, and would respectfully request that you do what you can to expedite matters, so that the permission required may be obtained with the least possible delay.

Very respectfully yours,

(Sgd.) J. N. ADAM,

Mayor, City of Buffalo, N.Y.

APPENDIX 'F.'

CITY OF BUFFALO, MAYOR'S OFFICE, July 9, 1906.

To His Excellency

The Governor General of Canada,

Through the Honourable the Secretary of State,

Washington, D.C.

SIR,—The city of Buffalo is situated at the foot of Lake Erie and along the upper waters of the Niagara river, as shown on the accompanying maps.

It at present takes it water supply from an intake pier in the swift waters of the Niagara river, as shown on the map. This is objectionable, as the water is often more or less polluted, and the intake pier is an obstruction to the free navigation of the river.

For many years the city has been studying the best method of improving its water supply, and by the advice of eminent sanitary and hydraulic engineers, has adopted a scheme of improvement which consists in building a new pumping station near the foot of Porter avenue, and intake pier in Lake Erie, and a tunnel leading therefrom to the new and old pumping station.

In order to get the best water obtainable, it is desired to locate the intake pier where it will receive the water from the middle of the lake as it flows to the Niagara river, and unpolluted from either shore. The proposed location is shown in red on the accompanying published chart of Buffalo harbour and on a larger scale on the accompanying blue print. While on the published chart the boundary line between Canada and the United States is not shown, it is understood to lie in the south and east of the proposed pier location, thus leaving the pier and a portion of the tunnel in Canadian territory.

The city of Buffalo desires and asks permission from Canada to locate, build and maintain its intake pier and connecting tunnel in the location shown.

It is desired to state that the pier location is on the edge of the reef on which is located the Horse Shoe reef lighthouse, which was built and is maintained by the United States under arrangements made between the two countries. Attention is invited to the fact that the location is out of the ordinary tracks of vessels, which are shown on the published chart, and can be no obstruction to navigation.

The matter has been investigated by the United States engineer at this point, a copy of whose report to the effect that the pier would be no obstruction to navigation is inclosed.

Acting on the information thus obtained, the government of the United States, through the President and Congress, has passed an Act authorizing the city of Buffalo to build the pier and tunnel as proposed. A copy of this law is herewith inclosed.

The proposed intake pier is to be 110 feet in diameter, built of steel and concrete, and with a small wooden, stone-filled landing crib adjacent to it. The crib will be lighted at all times. The tunnel will be about 65 feet below mean lake level, so that it cannot interfere with navigation in the least.

In order that the work may proceed with the utmost rapidity, the city of Buffalo respectfully requests as early action as practicable on this, its formal request to Canada.

Very respectfully yours,

(Sgd.) J. N. ADAM,
Mayor, City of Buffalo, N.Y.

APPENDIX 'G.'

Copy of Report of Col. H. M. Adams, Corps of Engineers, on application of the city of Buffalo, New York, to construct a tunnel and inlet pier in Lake Erie.

U. S. Engineer's Office,

Buffalo, N.Y., June 1, 1906.

Respectfully returned to the Chief of Engineers, U.S. Army.

An Act of Congress approved March 2, 1905, provides:—

'That it shall be lawful for the city of Buffalo, in the state of New York, to construct and maintain a tunnel under Lake Erie, Niagara river, Black Rock harbour and the United States lands known as Fort Porter, extending from a point 200 yards more or less northeast of the Horse Shoe Reef light, in the Emerald channel, ten thousand feet to the present pumping station of the city of Buffalo, and to erect and maintain an inlet pier therefrom, said inlet pier to be located in the Emerald channel, not more than six hundred feet northeast of the present Horse Shoe Reef light; Provided, that the top of the said tunnel shall be located at least forty feet below mean lake level, and that the city of Buffalo shall maintain a light from sunset to sunrise on the inlet pier, at its own expense.

'The present application is for permission to construct a tunnel and inlet pier as authorized by the above Act, except that the inlet pier now proposed will be about one thousnad feet southeasterly from Horse Shoe Reef light instead of "not more than six hundred feet northeast" of it. It is not believed that this change in location will injuriously affect navigation.

'The proposed inlet pier, and about one thousand seven hundred and fifty feet of the proposed tunnel will be in Canadian waters, as shown by maps of the Treaty of Ghent, establishing the international boundary line.

'The Horse Shoe Reef light is also on the Canadian side of the boundary, and on December 9, 1850, at a conference held at the British Foreign Office between Viscount Palmerson and Abbott Lawrence, Esq., the American Minister, it was agreed that England should cede to the United States "such portion of the Horse Shoe Reef as may be found requisite for the intended lighthouse, provided the government of the United States will engage to erect such lighthouse and to maintain a light thereon; and provided no fortification be erected on said reef."

A sketch map showing the locality and the boundary line is herewith inclosed.

H. M. ADAMS,

Colonel, Corps of Engineers.

APPENDIX 'H.'

Department of Public Works,

Buffalo, N.Y., May 24, 1906.

Hon. William H. Taft.

Secretary of War, Washington, D.C.

Dear Sir,—The city of Buffalo, in the effort to improve its water supply, is desirous of having a new intake pier in Lake Erie, and a tunnel connecting it with a pumping station in the city.

The intake pier, it is proposed, shall be located at about the point indicated on the accompanying map and which point may be described as follows:

About 300 feet south of a line adjoining the main breakwater light and the Horse Shoe Reef light, and about 1,000 feet from the latter light. The pumping station on shore would be near the foot of Porter Avenue, as shown on the accompanying map, and the tunnel would be practically on a straight line connecting the intake and pumping station, and with its top at least 30 feet below the bottom of the river, lake or improved channels, or practically 53 feet below mean lake level.

The intake pier would be circular in form and about 110 feet in diameter, with a small crib landing pier on its eastern side.

Your permission to build the proposed intake pier and tunnel is respectfully requested.

In asking your permission, it is respectfully represented to you that the location of the proposed intake is well away from any channel ordinarily travelled by lake or river boats, and will not be an obstruction to navigation. Attention is also invited to the fact that the proposed location is in the vicinity of the international boundary line between the United States and Canada. This line has never been marked on the ground, and it is impracticable to say whether the intake pier as proposed would be on the American or Canadian side of the line until the line is finally determined and marked through international action. As this determination and marking would undoubtedly take a long time, and as the need of the work of improving the water supply is urgent, it is respectfully requested that, in addition to granting your permission for the intake pier, you take the requisite and proper steps to secure the permission of Canada for the construction of the intake in advance of the final location and marking of the line.

The pier as proposed can work no possible harm to any navigation interests.

With your permission, it is desired that you insert any conditions which the city should fulfil in building and maintaining the pier and tunnel.

Respectfully yours,

(Sgd.) F. G. WARD,
Commissioner.

NOTE.—This letter confirms the plans filed by His Honour the Mayor, with the Chief of Engineers on or about February 1, 1906.

APPENDIX 'I.'

EXTRACT from a Report of the Committee of the Privy Council approved by the Governor General on July 20, 1906.

On a memorandum, dated July 13, 1906, from the Minister of Public Works, submitting that by Act of Congress, dated June 28, 1906, the city of Buffalo, New York, is authorized to construct and maintain a tunnel under Lake Erie, Niagara river, Black Rock harbour, and the United States lands known as Fort Porter, extending from a point one thousand feet more or less, southeasterly of the Horse Shoe Reef light eleven thousand feet to the present pumping station of the city of Buffalo, and to erect and maintain an inlet pier therefrom, said inlet pier to be located not more than one thousand one hundred feet southeasterly of the present Horse Shoe Reef light, the top of the said tunnel to be located at least forty feet below mean lake level, the proposed works being for the purpose of supplying the city of Buffalo with pure water.

That, however, attention is drawn to the fact that the proposed location of these works is in the vicinity of the international boundary line between the

United States and Canada. This line has never been marked on the ground and it is impracticable to say whether the intake pier as proposed would be on the United States or Canadian side until the line is finally determined and marked through international action. Application is therefore made to the Canadian government for permission to construct the said works.

The Minister states that the International Waterways Commission have examined into the matter. They state that the proposed tunnel and inlet pier can be built without injury to navigation, and they report favourably to the granting of the permission applied for.

The Minister, therefore, recommends that permission be given to the city of Buffalo to build the works above mentioned in Lake Erie, the location of which is shown on the plan hereto annexed, the said permission, however, to be revocable and subject to the following conditions: The top of the proposed tunnel shall be located at least forty feet below mean lake level, and the city of Buffalo shall maintain at its own expense a light on the said pier from sunset to sunrise.

The committee submit the same for approval.

(Sgd.) JOHN J. McGEE,
Clerk of the Privy Council.

APPENDIX 'J.'

MEMORANDUM.

Application of Chas. W. Smith—Regulating Richelieu river.

For navigation and power purposes a continuous flow of not less than 9,000 cubic feet per second is desired in the Richelieu river. The average annual flow is greater than this, being 12,000 cubic feet per second. The low water discharge is 3,000 cubic feet per second and there are periods sometimes extending over six or eight months when the discharge is continually less than 9,000. It is proposed to store up in Lake Champlain during the high water season enough of the surplus water to supply the deficiency during the low water season. For this purpose regulating works are to be constructed in the Richelieu river, by which the level of Lake Champlain will be maintained at a minimum of 97 feet above tide at New York, and it is stated that these works will not under any circumstances raise the high water level of Lake Champlain above 'the present high-water mark.' given as 101·5. Thus it is proposed to give the lake a range of 4·5 feet.

On page 324 of the 'Report of the Board of Engineers upon Deep Waterways between the Great Lakes and the Atlantic Tide Waters,' is a tabular statement of the monthly mean discharge of Lake Champlain for the years 1875 to 1898, inclusive. An examination of this table shows that the period which gave the lowest discharge, extended from September, 1882, to March, 1883; that which gave the next lowest extended from September, 1876, to March, 1877; that which gave the third lowest extended from September, 1883, to February, 1884; and that which gave the fourth lowest from August, 1894, to March, 1895. During these periods the amount flowing was less than 9,000 cubic feet per second, and in order to maintain that flow, it would have been necessary to draw from water previously stored for that purpose, the difference between 9,000 cubic feet and the amount which actually flowed.

The deficiencies for the first period were for

						Cubic feet.
September,	1882,	1,400	c. f. per second,	days	....	3,628,800,000
October	"	1,800	"	31	"	4,821,120,000
November	"	3,500	"	30	"	9,072,000,000
December	"	4,600	"	31	"	12,320,640,000
January	1883,	5,000	"	31	"	13,392,000,000
February	"	4,000	"	28	"	9,676,800,000
March	"	2,200	"	31	"	5,892,480,000
						58,803,840,000

The deficiencies for the second period were for

						Cubic feet.
September,	1876,	2,400	c. f. per second,	30 days	.....	6,220,800,000
October	"	3,000	"	31	"	6,033,200,000
November	"	3,300	"	30	"	5,553,600,000
December	"	4,000	"	31	"	10,713,600,000
January,	1877,	4,100	"	31	"	10,981,440,000
February	"	3,800	"	28	"	9,192,960,000
March	"	700	"	31	"	1,874,880,000
						55,572,480,000

The deficiencies for the third period were for

						Cubic feet.
September,	1883,	2,700	c.f. per second,	30 days	.....	6,998,400,000
October	"	4,300	"	31	"	11,517,120,000
November	"	4,300	"	30	"	11,145,600,000
December	"	4,100	"	31	"	10,981,440,000
January,	1884,	3,700	"	31	"	9,910,080,000
February	"	300	"	28	"	725,760,000
						51,278,400,000

The deficiencies for the fourth period were for

						Cubic feet.
August,	1894,	2,100	c. f. per second	31 days	.....	5,624,640,000
September	"	3,700	"	30	"	9,590,400,000
October	"	3,800	"	31	"	10,177,920,000
November	"	2,100	"	30	"	5,443,200,000
December	"	1,900	"	31	"	5,088,960,000
January,	1895,	1,200	"	31	"	3,214,080,000
February	"	1,600	"	28	"	3,670,720,000
March	"	1,400	"	31	"	3,749,760,000
						46,759,680,000

The area of Lake Champlain is 436·7 square miles, or 12,174,497,280 square feet. The depth required to store the deficiency during the first of the above periods is 4·81 feet; that for second period is 4·56 feet; for the third period it is 4·21 feet, and for the fourth period it is 3·84 feet. Adding 1.25 feet for evaporation in eight months, those depths become 6·6, 5·81, 5·46 and 5·9 respectively. The range proposed, 4·5 feet, will, therefore, not be sufficient to provide 9,000 cubic feet per second throughout the low water season in very dry years.

A range much greater cannot be admitted without inflicting damage either upon the riparian owners or to navigation interests of Lake Champlain. In determining what is proper high water and what proper low water stage in this connection, it is not fair to take the extremes which the lake may have reached at

intervals in its history. A high water stage reached once in twenty years, for long example, might inflict damage to property without destroying it, while if reached every year it might cause complete destruction, likewise the obstruction to navigation, caused by extreme low water stage, would be greatly multiplied, if repeated every year.

The table on page 323 of report on Deep Waterways quoted above gives the monthly mean stages of Lake Champlain from 1875 to 1898. The highest stage there recorded is 100:13 for the month of April, 1896. Upon only two other occasions did the stage reach 100. To raise the level above 100 regularly every year would be to inflict an injury upon riparian proprietors.

The mean elevation of the lake for the entire period was 96·10. The lowest stage reached was 93·65. During seven years it did not fall below 95. To allow the lake to be drained below 95 every would be to inflict injury upon the navigation interests.

The limits between which the lake should be regulated are therefore, 100 as a maximum and 95 as a minimum, notwithstanding that the reserve of water will not, in very dry years, be sufficient to supply 9,000 cubic feet per second.

APPENDIX 'K'.

SPECIAL instructions to fishery officers, ex-officio magistrates in command of government steamers and vessels, engaged as Fisheries' police vessels in protecting the inshore fisheries of Canada.

OTTAWA, March 16, 1886.

SIR,—In the performance of the special and important service to which you have been appointed, you will be guided by the following confidential instructions:

For convenience of reference, these have been divided under the different headings of powers, jurisdiction, duties and general directions.

POWER.

The power with which you are invested is derived from, and to be exercised in accordance with the following statutes, among others, 'The Fisheries Act', (31 Vic., cap. 60, of Canada), 'An Act respecting fishing by foreign vessels' (31 Vic., cap. 61, of Canada.)

And the subsequent statute entitled, 'An Act to amend the Act respecting fishing by foreign vessels' made and passed the 12th May, 1870 (33 Vic., cap. 15, of Canada); also an 'Act to further amend the said Act' (34 Vic., cap. 23, of Canada.)

'Chapter 94 of the Revised Statutes (third series) of Nova Scotia (of the Coast and Deep Sea Fisheries), amended by the Act entitled, 'An Act to amend Chapter 94, of the Revised Statutes of Nova Scotia' (29 Vic., cap. 35).

An Act passed by the Legislature of the Province of New Brunswick, entitled, 'An Act relating to the coast fisheries and for the prevention of illicit trade' (16 Vic., cap. 69).

Also an Act passed by the Legislature of Prince Edward Island (6 Vic., cap. 14) entitled, 'An Act relating to the fisheries and for the prevention of illicit trade in Prince Edward Island and the coasts and harbours thereof.'

Also from such regulations as have been passed or may be passed by the Governor General in Council, or from instructions from the Department of Fisheries, under 'The Fisheries Act', hereinbefore recited.

As fishery officer you have full authority to compel the observance of the requirements of the Fisheries Acts and Regulations by foreign vessels and fishermen, in those parts of the coasts of Canada to which, by the convention of 1818, they are admitted to privileges of taking or drying and curing fish concurrent with those enjoyed by British fishing vessels and fishermen.

You will receive instructions from the Customs Department authorizing you to act as an officer of the Customs, and in that capacity you are to see that the revenue laws and regulations are duly observed.

JURISDICTION.

Your jurisdiction, with respect to any action you may take against foreign fishing vessels and citizens engaged in fishing is to be exercised only within the limits of 'three marine miles' of any of 'the coasts, bays, creeks or harbours of Canada.

With regard to the Magdalen islands, although the liberty to land and dry and cure fish there is not expressly given by the terms of the convention to United States fishermen, it is not at present intended to exclude them from these islands.

DUTIES.

It will be your duty to protect the inshore fisheries of Canada in accordance with the conditions laid down by the convention of October 20, 1818, the first article of which provides:

'Whereas differences have arisen respecting the liberty claimed by the United States, for the inhabitants thereof, to take, dry and cure fish, on certain coasts, bays, harbours and creeks of His Britannic Majesty's dominions in America, it is agreed between the high contracting parties that the inhabitants of the said United States shall have, forever, in common with the subjects of His Britannic Majesty, the liberty to take fish of every kind, on that part of the southern coast of Newfoundland which extends from Cape Ray to the Rameau islands, on the western and northern coasts of Newfoundland, from the said Cape Ray to the Quirpon islands, on the shores of the Magdalen islands, and also on the coasts, bays, harbours, and creeks from Mount Joly, on the southern coast of Labrador, to and through the Straits of Belle Isle, and thence northwardly indefinitely along the coast, without prejudice, however, to any of the exclusive rights of the Hudson Bay Company; and that the American fishermen shall also have liberty, forever, to dry and cure fish in any of the unsettled bays, harbours and creeks, of the southern part of the coast of Newfoundland, hereabove described, and of the coast of Labrador; but as soon as the same, or any portion thereof, shall be settled, it shall not be lawful for the said fishermen to dry or cure fish at such portion so settled, without previous agreement for such purpose with the inhabitants, proprietors, or possessors of the ground.

'And the United States hereby renounces forever any liberty heretofore enjoyed or claimed by the inhabitants thereof, to take, dry or cure fish on or within three marine miles of any of the coasts, bays, creeks or harbours of His Britannic Majesty's dominions in America, not included within the above mentioned limits; provided, however, that the American fishermen shall be permitted to enter such bays, or harbours, for the purpose of shelter and repairing of damage therein, of purchasing wood and of obtaining water, and for no other purpose whatever. But they shall be under such restrictions as may be necessary to prevent their taking or curing fish therein, or in any other manner whatever abusing the privileges hereby reserved to them.

By this you will observe, United States fishermen are secured the liberty of taking fish on the southern coasts of Labrador, and around Magdalen islands and of drying and curing fish along certain of the southern shores of Labrador, where the coast is unsettled, or if settled, after previous agreement with the settlers or owners of the ground.

In all other parts the exclusion of foreign vessels and boats is absolute, so far as fishing is concerned, and is to be enforced within the limits laid down by the convention of 1818, they being allowed to enter bays and harbours for four purposes only, viz.: for shelter, the repairing of damage, the purchasing of wood, and to obtain water.

You are to compel, if necessary, the maintenance of peace and good order by foreign fishermen pursuing their calling and enjoying concurrent privileges of fishing or curing fish with British fishermen, in those parts to which they are admitted by the treaty of 1818.

You are to see that they obey the laws of the country; that they do not molest British fishermen in the pursuit of their calling, and that they observe the regulations of the fishery laws in every respect.

You are to prevent foreign fishing boats and vessels which enter bays and harbours for the four legal purposes above mentioned, from taking advantages thereof, to take, dry or cure fish therein, to purchase bait, ice or supplies, or to tranship cargoes, or from transacting any business in connection with their fishing operations.

It is not desired that you should put a narrow construction on the term 'unsettled'. Places containing a few isolated houses might not, in some instances, be susceptible of being considered as 'settled' within the meaning and purpose of the convention. Something would, however, depend upon the facts of the situation and circumstances of the settlement. Private and proprietary rights form an element in the consideration of this point. The generally conciliatory spirit in which it is desirable that you should carry out these instructions, and the wish of Her Majesty's government that the right of exclusion should not be strained, must influence you in making as fair and liberal an application of the term as shall consist with the just claims of all parties.

Should interference with the pursuits of British fishermen or the property of Canadians appear to be inseparable from the exercise of such indulgence, you will withhold it, and insist upon entire exclusion.

United States fishermen should be made aware that, in addition to being obliged, in common with the subjects of Her Majesty, with whom they exercise concurrent privileges of fishing in Colonial waters, to obey the laws of the country, and particularly such Acts and Regulations as exist to ensure the peaceable and profitable enjoyment of the fisheries by all persons entitled thereto, they are peculiarly bound to preserve peace and order in the quasi settled places to which, by the liberal disposition of Canadian authorities, they may be admitted.

Wheresoever foreigners may fish in Canadian waters, you will compel them to observe the Fishery Laws. Particular attention should be directed to the injury, which results from cleaning fish on board their vessels, while afloat, and the throwing overboard of offals, thus fouling the fishing, feeding and breeding grounds. 'The Fisheries Act' (Section 14) provides a heavy penalty for this offence.

Take occasion to inquire into and report upon any modes of fishing, or any practices adopted by foreign fishermen, which appear to be injurious to the fisheries.

GENERAL DIRECTIONS.

You will accost every foreign fishing vessel, within the limits described, and if that vessel should be either fishing, preparing to fish, or should obviously

have been fishing within the prohibited limits, you will, by virtue of the authority conferred upon you by your commission, and under the provision of the Acts above recited, seize at once (resort to force in doing so being only justifiable after every effort has failed), any vessel detected in violating the laws, and send her, or take her, into port for condemnation.

Copies of the Acts of Parliament subjecting to seizure and forfeiture any foreign ship, vessel or boat which should be either fishing, preparing to fish or should obviously have been fishing within the prohibited limits, and providing for carrying out the seizure and forfeiture are furnished herewith for your information and distribution.

Should you have the occasion to compel any foreign fishing vessel or fishermen to conform to the requirements of the 'Fisheries Act and Regulations,' as regards the modes and incidents of fishing, at those places to which they are admitted under the Convention of 1818, particularly in relation to ballast, fish offals, setting of nets, hauling of seines, and use of 'trawls' or 'bultows' more especially at and around the Magdalen Islands, your power and authority, under such cases, will be similar to that of any other fishery officer appointed to enforce the Fishery Laws in Canadian waters (Vide Fisheries Act).

If a foreign ship, vessel or boat be found violating the convention or resisting consequent seizure and momentarily effects her escape from the vicinity of her capture or elsewhere, she remains always liable to seizure and detention, if met by yourself in Canadian waters, and in British waters everywhere, if brought to account by Her Majesty's cruisers. But great care must be taken to make certain of the identity of any offending vessel to be so dealt with.

All vessels seized, must be placed, as soon as possible, in the custody of the nearest custom collector, and information, with a statement of the facts and the deposition of your sailing master, clerk, lieutenant, or mate, and of two at least of the most reliable of your crew, be despatched, with all possible diligence to the government. Be careful to describe the exact locality where the violation of the law took place, and the ship, vessel or boat was seized. Also corroborate the bearings taken, by soundings, and by buoying the place (if possible), with a view to actual measurement, and make such incidental reference to conspicuous points and land marks as shall place beyond doubt the illegal position of the seized ship, vessel or boat.

Omit no precaution to establish, on the spot that the trespass was or is being committed, within three miles of land.

As it is possible that foreign fishing craft may be driven into Canadian waters by violent or contrary winds, by strong tides, through misadventure, or some other cause independent of the will of the master and crew, you will consider these circumstances, and satisfy yourself with regard thereto before taking extreme step of seizing or detaining any vessel.

On capture it will be desirable to take parts of the foreign crew aboard the vessel under your command, and place some of your own crew, as a measure of precaution, on board the seized vessel; first lowering the foreign flag borne at the time of the capture. If your ordinary complement of men does not admit of this being done, or if, because of several seizures, the number of your hands might be too much reduced, you will, in such emergency, endeavour to engage a few trustworthy men. The portion of the foreign crew taken on board the government vessel you will land at the nearest place where a consul of the United States is situated, or where the readiest conveyance to any American consulate in Canada may be reached, and leave them there.

When any of Her Majesty's vessels about the fishing stations or in port are met with, you should, if circumstances permit, go on board and confer with the naval commander, and receive any suggestions he may feel disposed to give, which do not conflict with these instructions, and afford him any information

you may possess about the movements of foreign craft; also inform him what vessels you have accosted and where.

Do not fail to make a full entry of all circumstances connected with foreign fishing vessels, noting their names, tonnage, ownership, crew, port, place of fishing, cargo, voyage, and destination, and (if ascertainable), their catch. Report your proceedings as often as possible, and keep the department fully advised on every opportunity, where instructions would most probably reach you at stated intervals.

Direction as to the stations and limits on which you are to cruise, and any further instructions that may be deemed necessary, will from time to time, be conveyed to you.

Considerable inconvenience is caused by Canadian fishing vessels neglecting to show their colours. You will draw the attention of masters to this fact, and request them to hoist their colours without requiring to be hailed and boarded.

It cannot be too strongly urged upon you, nor can you too earnestly impress upon the officers and crew under your command, that the service in which you and they are engaged should be performed with forbearance and discrimination.

The government relies on your prudence, discretion and firmness in the performance of the special duties entrusted to you.

I am, sir, your obedient servant,

(Signed) GEORGE E. FOSTER,
Minister of Marine and Fisheries.

DEPARTMENT OF MARINE AND FISHERIES,

OTTAWA, October 27, 1894.

SIR,—You are hereby instructed to proceed, without delay, to Amherstburg, and take up your station at the western end of Lake Erie. It is reported to the department that United States fishing tugs from Erie, Cleveland, Sandusky and Toledo, are in the habit of following the whitefish and herring which at this season are moving to their spawning grounds among the islands at the western end of the lake and in Detroit river.

Among the islands there can be no doubt about the exact position of the boundary line, so that you can then have no difficulty in deciding whether fishing is carried on by foreign vessels or boats in Canadian waters.

In the event of seizure being made, you will establish exactly the position of the seizure by cross bearings, if necessary you should also buoy the position of the seizure, so that you can accurately fix the position, after having made the seizure, by direct measurements, from the shore. You will note and report to the department the extent to which fishing is carried on during the fall season and the spawning grounds in the United States waters at the head of Lake Erie.

I am, sir, your obedient servant,

(Signed) JOHN HARDIE,
For Deputy Minister of Marine and Fisheries.

Captain E. DUNN,
Petrel,
Care of T. H. ELLIOTT,
Sault Ste. Marie, Ont.

SESSIONAL PAPER No. 19a

DEPARTMENT OF MARINE AND FISHERIES,

OTTAWA, March 27, 1894.

SIR,—I have to instruct you to commission the *Petrel* on the 15th of April or immediately navigation opens. You are to cruise round Pelee and the Canadian island for the purpose of seizing American gill nets if set. Grapnels are to be used, if necessary, and they are to be constructed as follows: A piece of iron 3 feet long, ¾ of an inch thick, with a hole punched 4 inches from point and a line attached. You are always to harbour, if possible, in a Canadian port. After remaining around the island until about the 1st of May, then proceed to Point Pelee, and keep a sharp lookout for our own fishermen fishing gill nets without a license, from thence to Rondeau bay, when the open waters of the bay should be searched for gill nets, returning to Pelee island about the 15th of May, remaining in this vicinity till the beginning of June; this is considered a very important season, as a good many American vessels come over to catch bass during the close season.

The *Petrel* should then return to Lake Huron until about the 20th June, remaining there as long as necessary, and come back to Lake Erie and cruise in front of Point Pelee, Port Stanley, Bruce and Port Burwell, where American nets are reported to fish gill nets at this time of the year in deep waters from 6 to 12 miles from the Canadian shore. She should cruise round these points till the middle of July, then proceed to Georgian Bay, to look after the salmon trout and whitefish fisheries. At the beginning of September you will have to return to look after bass fishing in the neighbourhood of the Canadian islands off and on until the end of the season. You will then have to take particular care with regard to encroachments by foreign fishermen, and also with regard to fishing during close season for whitefish.

Outside these instructions you will use your own discretion as to the best means of protecting the fisheries.

The commander of the Fisheries Protection Service has been requested to send you a supply of rifles and cutlasses. You will purchase the ammunition at the best and cheapest place. Commander Spain has also been told to send you the general instructions as regards drill, discipline, &c., which are carried on board the other vessels of the fleet under his command. The *Petrel* will be inspected at irregular intervals by the commander of the Protection Service.

I am, sir, your obedient servant,

(Signed) JOHN HARDIE,

For Deputy Minister of Marine and Fisheries.

Captain DUNN,

Owen Sound, Ont.

DEPARTMENT OF MARINE AND FISHERIES,

OTTAWA, October 26, 1893.

SIR,—Adverting to the general instructions given you on the 8th ultimo, I am to direct you to prevent poaching by United States tugs and boats in Canadian waters, a practice which this department has reason to believe is extensively carried on in Lake Huron, especially between Point Edward and Point Clarke, and in the neighbourhood of Detroit. All nets which you may find set on the Canadian side of the boundary, belonging to foreigners, should be seized and confiscated, and the fact immediately reported to the department, with full details as to the time and place of seizure, the number and length of nets, &c.

I inclose, for your information and guidance, copy of the statute relative to fishing by foreign vessels.

You will accost every United States vessel or boat which you may notice in Canadian waters, and if either fishing, preparing to fish or having obviously fished within the exclusive limits, you will, in accordance with the above statute, seize at once any such vessel or boat detected in violating the law, and immediately place her under the charge of the nearest Collector of Customs for safe keeping; pending action by this department. Then you are to send, at once, full information, of such seizure, with a statement of the fact and the deposition of the captain and one or two of the most reliable and intelligent of the crew. Be careful to describe the exact locality where the unlawful fishing took place, and the vessel or boat seized. Corroborate the bearings taken by soundings and by reference to conspicuous points and land marks, as shall place, beyond doubt, the illegal position of the illegal vessel or boat. In fine, you should omit no reasonable endeavour to establish beyond dispute that the illegal fishing was in Canadian waters.

The department relies upon your prudence to carry out the above directions, with firmness and discretion.

Inquire as you go along about the manner in which each overseer attends to his work, and report at once any one who may be neglectful or inattentive to his duties.

You will undoubtedly, in the course of your cruise, be able to collect valuable information as regards the present state of the fisheries on each side of Lake Huron, the principal breeding grounds of whitefish, salmon trout and herring; on the places which require the greatest amount of protection, in fact on all matters looking to an improved and more efficient system of protection for these waters. This information should be carefully noted down with facts and data in support, for the purpose of being embodied in a general report which you will make at the end of your cruise.

State when you will be ready to sail on your cruise.

I am, sir, your obedient servant,

(Signed) WM. SMITH,
Deputy Minister of Marine and Fisheries.

Captain E. DUNN,
Owen Sound, Ont.

DEPARTMENT OF MARINE AND FISHERIES,

OTTAWA, September 8, 1893.

SIR,—The Minister having decided to give you another trial as fishery officer in command of the Government Cruiser *Petrel*, I have been directed to prepare the following instructions for your guidance:—

1. Until further orders, you will pay particular attention to the protection of fish and to the enforcement of the fishery laws and regulations in the waters of Lake Huron and Georgian bay. Should it be found advisable at any time to extend the field of your action, you will be accordingly instructed.

2. You are already familiar with the fishery laws and regulations, applicable to the waters under your charge. Within these limits, you will, when necessary, exercise magisterial functions, as provided by section 2, chap. 95, Revised Statutes of Canada.

The various fishery officers within these limits (a schedule of which is herewith attached), will be under your immediate directions, as well as to the general and special instructions from this department which may be furnished

to you and to them from time to time. You will see that they attend to their work, and report any failure on their part to do so.

3. The duties of your office relate chiefly to the enforcement of the fishery laws and regulations. Copies are herewith, for your information, as well as copies of the latest departmental reports. Particular attention should be given to the following points:—

(*a*) The constant inspection and actual examination into the actual conditions of the fisheries within your district;

(*b*) Their produce and destruction, the men, material, tonnage, etc., engaged in them, the details of the fishing industry as an important branch of the country's commerce;

(*c*) You are to ascertain whether abusive practices prevail, and to suggest remedies and improvements of existing regulations, which may be in your opinion needed;

(*d*) Mill dams or other obstructions on rivers should be reported upon, with a view to rendering them passable for fish;

(*e*) You are to strictly enforce the statutes respecting sawdust and mill rubbish whenever you find the law violated or complaints are made to you.

4. An important part of your duty consists of prosecution 'on view,' as provided by section 17 of the statute, or upon the information of the local officers or others, of all offenders against any of the fishery laws or regulations. It is, therefore, desirable to give you some instructions on this head.

You will be careful to advise officers in your district to engage in no litigation, but to report to you in case of necessity, when you will at once conduct such matters to a conclusion. Convicting persons 'on view' without any form of process is improper. Power to a magistrate to convict on his own view is, in the main, a summary way of dispensing with all other testimony, except that of the convicting justice. It does not do away with the necessity of a summons, either oral or in writing, neither does it preclude defence. Each case must be duly recorded and a regular conviction afterwards formulated, stating that it is 'on view' had of the offence, that a conviction is made. You may cite the offender by oral command, or by summons in writing, after hearing his plea or defence and after considering any extenuating circumstances if such there be, and such as are admissible in mitigation of the penalty, proceed forthwith, in the presence of the defendant, to impose a fine, etc., with the alternative of imprisonment. In such cases no complaint is necessary. No part of the penalty accrues to the convicting officer, the whole belongs to the Crown.

The penalty provided by section 18 of the Fisheries Act for each offence varies from $1 to $20, in the discretion of the convicting officer or magistrate. The department favours the imposition of the highest penalty, because as a rule, small fines do very little good.

All materials, implements or appliances used in contravention of the Fisheries Act, or the regulations made under it, are liable to confiscation in addition to the penalty imposed.

5. The mode of rendering your monthly accounts is fully explained in the circular herewith, and the blank forms supplied for your use. In connection with this matter, the Minister desires to impress upon you the necessity of being as economical as possible in your expenses, always keeping the efficiency of the service in view. You will keep a full and complete diary of every day's work, in which you will note down not only the name and address of every one to whom you pay money, but the purpose for which such money was expended; the reasons for every journey; the results of each visit, &c.

6. As clearly as possible after the 1st of December, you will furnish this department with a full and detailed report of your operations and the state of the fisheries within the district under your charge. You will append to this report

full returns of the yield of the fisheries of the whole division, for which purpose blank forms will be sent you.

7. The principal part of your division where illegal fishing is known to be most prevalent, is on the northeastern coast of Georgian Bay, between Moon river and Byng inlet. This part of the coast is under charge of Overseer Jackson, of Midland Harbour. On your first visit to that part of the coast, you will take him with you, his intimate knowledge of the localities and of the fisheries will be of great advantage to you.

8. A good deal of illegal fishing is also carried on near the mouth of French river, around the Bustard islands; at Badgley island, near Wikwemikong, and at Little Current. These places are under charge of Overseer Elliott, of Sault Ste. Marie, with whom you will arrange to accompany you when you visit these localities.

9. The department has also reason to believe that a good deal of illegal fishing takes place every fall at the Fishing islands, Lake Huron, as well as at other places in that neighbourhood, along the coast of the county of Bruce.

In this connection you will see that no seine hauling is done at Sauble beach.

10. Instruct the several officers on Georgian bay to keep a sharp lookout for freezers and shipping of fish during the close season. The department has reason to believe that a great many evasions and violations of the law occur through neglect of fishery officers on this head; especially at Collingwood, where Overseer Donaldson is located. You will direct him to maintain a strict watch over the Nottawasaga river and see that no illegal fishing is carried on there.

11. You are personally acquainted, it is presumed, with Overseer Elliott, and the extent of his work. It is, therefore, unnecessary to give you any special directions on this head. It will be well, however, to remind you to keep in constant communication with him, so as to advise him of any illegal fishing which may take place in the most distant parts of his division, that is to say, Spanish and French rivers, and around the south and southeastern shores of Manitoulin island. In the latter connection, you will keep an eye on Mutchmore's mill, at Providence Bay, and see that the law relative to sawdust is strictly carried out

12. The close season for whitefish and salmon trout will as usual be from 1st to 30th November, both days inclusive. All the licenses issued this year for fishing in the waters of Lake Huron and Georgian bay expire on October 31. All gill-nets or pound nets which you may find in the water after October 31 should be destroyed, the fish confiscated and sold and the parties prosecuted.

13. Keep the department regularly and fully advised of your movements. Telegraph only on matters of importance. Mail facilities are sufficiently prompt for the general requirements of the service.

14. When you require advice, communicate with the department, giving a full statements of facts involved.

Let every matter in your correspondence form the subject of a separate letter. This obviates confusion and assures prompt attention.

All your official communications should be addressed to the Deputy Minister of Marine and Fisheries.

A supply of stationery is herewith for official use.

I am, sir, your obedient servant,

(Sgd.) JOHN HARDIE,

For Deputy Minister of Marine and Fisheries.

Captain E. DUNN,

Owen Sound.

SESSIONAL PAPER No. 19a

Department of Marine and Fisheries,

Ottawa, September 10, 1890.

Sir,—I have the honour to inform you of your appointment by His Excellency the Governor General in Council, to the command of the government steam yacht, *Cruiser*, and as a fishery officer for the Great Lakes and Georgian bay, with magisterial jurisdiction under the Fisheries Act on these waters and vicinity.

The forms of oath of office, which are herewith, you will be good enough to attest to, before a justice of the peace, and return them to the Fisheries Department at your earliest convenience. I also inclose for your information and guidance, copies of the Fisheries Act and Regulations (the latter having equal power with the Act itself). It is desirable that you should, without delay, make yourself conversant with this Act and the regulations made.

You have already been directed by telegraph to take command of the *Cruiser* at Owen Sound, and have her at once fitted for service. The vessel is to be employed for the present season in Lake Huron and the Georgian bay, in the joint protectorate of the customs and the fisheries.

Your instructions and authority as to the former service will be furnished you by the Customs Department, to which department you will report on all matters connected with that branch of the service.

You will proceed with all possible despatch to cruise in the Georgian bay, calling first upon Fishery Overseer Shackleton, at Colpoy's bay. It is desirable that you should take him on board the *Cruiser* and go over his district with him. From Overseer Shackleton and the other overseers upon whom you may subsequently call, you may obtain much general information as regards the fisheries, especially looking to an evil which the department believes to exist in the unlimited use of gill-nets and the totally inadequate fee of $5 per boat, which is now paid for the privilege of a season's fishing with 6,000 yards of gill-nets.

After leaving Overseer Shackleton, you will (unless more important work present itself), visit Overseer George S. Miller, at Owen Sound, and in turn F. G. M. Fraser at Victoria Harbour.

Upon completing an inspection of the districts of these overseers, you had better proceed to Manitowaning, and there take on board Overseer A. Drinkwater. It is desirable that he should accompany you around Fitzwilliam, Club Squaw and other islands south of Manitoulin island. You will then work your way to Sault Ste. Marie, calling upon Captain Joseph Wilson, fishery overseer at the Sault. You will find Captain Wilson an officer of large experience and able to give you much valuable information, both as regards the customs and the fisheries.

If it can be arranged that Captain Wilson should accompany you over his division, you will find his presence of advantage.

The department has reason to believe that considerable fishing is carried on by United States subjects in the Georgian bay, without having taken out a license. It will therefore be your duty to speak all boats you may see fishing. Ascertain the names of the owners and where the boats belong.

To aid you in detecting illegal fishing, a list of the licenses that have been issued through the several overseers is inclosed herewith.

In carrying out the general instructions hereby conveyed, you are at liberty to exercise your judgment in deviating therefrom for the purpose of examining any matters appertaining to the customs service, which you may deem essential.

You are required to carry out the service committed to your charge with the due regard to economy, and at all times keep in view its efficiency, taking notes in all points relating to the fisheries which you may deem of interest to the department.

The length of nets, the service of the mesh, the number of men employed, the markets in which the fish are disposed of, the due observance of the close season, are all details which may profitably engage your attention. The inclosed pay-list will inform you as to the crew carried by the *Cruiser* last season; this number is not to be exceeded without the department's authority. You will furnish weekly to this department a copy of the *Cruiser's* log and also fill in the boarding reports with which you have been furnished. The crew will be paid monthly upon a pay-list certified by you and transmitted to the department.

In navigating your vessel, there is no need that any risk should be incurred, and you will always have regard for the responsibility attaching to your command. Whenever in waters with which you are not familiar and the presence of a pilot is necessary, you are authorized to engage one. All accounts for supplies or fuel furnished the *Cruiser* are to be rendered in duplicate and certified by you as correct, both as regards the quantity and price, and transmitted to the department for payment. Such reasonable advances for the steamer's incidental expenses as may be necessary, will from time to time be made to you.

The size of the mesh of nets having been fixed at 4½ inches, you are to take great care that no nets are allowed to be used under this size, and if such are found in use, they are to be seized and destroyed, and you are to prosecute all offenders for any irregularities.

Discretionary power with reference to the offences against the Fisheries Act or Regulations is alone to be exercised by the Minister, after having from you a full report of the case requiring consideration.

The close season for salmon trout and whitefish is from 1st to 30th of November.

I am, sir, your obedient servant,

(Sgd.) JOHN TILTON,

Deputy Minister of Marine and Fisheries.

Captain E. Dunn,
Owen Sound, Ont.

APPENDIX 'L'

Department of State,

Washington, September 5, 1906.

The Honourable

The Secretary of War.

Sir,—I have the honour to inclose herewith a copy of a letter from Mr. H. C. Schacht, secretary of the Keystone Fish Company, of Erie, Pa., transmitting a communication from the commander of the Canadian cruiser *Vigilant*, proposing to log and mark by buoys the exact international water boundary line, thereby enabling fishermen to keep on their side of the line.

As it is stated that difference of opinion as to the exact location of the boundary line exists between the interested parties, I should be very much obliged if you should cause this to be referred to the International Waterways Commission, with the inquiry whether it is known that the American and Canadian charts of the locality agree as to the distance to be logged from the gas buoy at Erie to the boundary line on the usual fishing grounds. An exa-

mination some years ago showed that the maps of the Ghent Commissioners were not accurately scaled, Lake Erie being drawn wider than it really is, so that the distances logged according to those maps from either shore to the treaty boundary as drawn thereon would lap appreciably at the middle of the lake.

I have the honour to be,

Your obedient servant,

ROBERT BACON,

Acting Secretary

From H. C. Schacht as above, August 25, 1905, with inclosure.

KEYSTONE FISH COMPANY,

ERIE, PA., August 25, 1906.

Honourable Secretary of State,

Washington, D.C.

SIR,—Referring to the attached copy of communications received from Capt. Dunn, of the C. G. S. *Vigilant*, would ask if it could not be arranged to have one of the American cutters operate in conjunction with Captain Dunn to establish the exact location of the boundary line.

There seems to be considerable difference of opinion between our captains and Captain Dunn as to the location of the line, and we would urge that immediate action be taken in this matter. There are from 40 to 50 boats operating out of this port at the present time and a seizure may be made any day.

Awaiting your prompt action, we remain,

Respectfully yours,

KEYSTONE FISH CO.,

H. C. SCHACHT, *Secretary.*

Keystone Fish Company,

Erie, Pa.

SIR,—If the fishermen intended setting their nets in their own waters and in the future intend to do so, I would make this proposition to them:

That they furnish several large conspicuous buoys and send a responsible person with me, I will come over there and log the distance for them from the gas buoy at Erie to the line where they usually fish and they will then be enabled to keep on their side of the line if they desire to do so.

They can communicate with me at Port Stanley.

Very truly yours,

E. DUNN,

Commanding *Vigilant.*

DEPARTMENT OF STATE,

WASHINGTON, September 7, 1906.

The Honourable

The Secretary of State.

SIR,—I have the honour to inclose herewith copy of a letter from the Keystone Fish Company, relative to the seizure by the Canadian cruiser *Vigilant* of the nets of the American steamer *Erie*, and to refer to this department's recent letter (the 5th instant), on the same subject; namely, agreement as to distance to be logged from a fixed point to the boundary line.

The Keystone Company has been advised that the department has taken steps to find out what the line is and that, in the meantime, their remedy is in the Canadian courts.

I have the honour to be, sir,

Your obedient servant,

ROBERT BACON,
Acting Secretary.

Inclosure,

From Keystone Fish Company, August 21, 1906.

KEYSTONE FISH COMPANY,
Catchers and Shippers of Fresh Fish,
ERIE, PA., August 21, 1906.

Secretary of Treasury,

Department of Customs, Washington, D.C.

SIR,—We wish to call your attention to the high-handed action taken by Captain Dunn, of the Canadian cruiser *Vigilant*.

On August 20 our steamer *Erie* set out 112 nets 14½ miles north-northwest of Erie in a southwesterly and northeasterly direction according to hydrographic charts No. 14,477. These nets were set in United States waters. On the 21st the *Erie* was only able to find 16 nets, the balance having been confiscated by the *Vigilant*.

All our captains have positive instructions to keep on this side of the boundary line, and they are as well able to determine the location of the line as Captain Dunn. But neither Captain Dunn nor our captains can determine the location of the line within a few feet.

Could it not be arranged to have an American cutter patrol the line to protect our interests and also definitely determine the location of the line? As it now stands it is left entirely to Captain Dunn.

Our fishing territory is very limited at best, and we demand protection for our property when in United States waters. We are at least entitled to fish up to the line.

If Captain Dunn continues in this matter, our boats will be compelled to stay from one to two miles this side of the line to be safe from confiscation.

Our captains cannot be governed by where the *Vigilant* runs in going up and down the lake, as she varies from three to four miles from day to day.

The nets seized were worth from $550 to $600, which amount, we think, should be recovered from the Canadian authorities.

Your prompt attention to this matter will greatly oblige,

Respectfully,

KEYSTONE FISH CO.,
H. C. SCHACHT.

SESSIONAL PAPER No. 19a

SECOND PROGRESS REPORT.

DECEMBER 1, 1906.

International Waterways Commission,
Office of Chairman American Section,
Room 328, Mills Building Annex,

WASHINGTON, D.C., November 27, 1906.

Mr. SECRETARY: 1. The American members of the International Waterways Commission have the honour to submit the following progress report covering their work for the year ending December 1, 1906.

ORGANIZATION.

2. The commission suffered a very serious loss in the death at Detroit, on the 3rd of July last, of Mr. George Y. Wisner, one of its most valued members. At its meeting in Toronto, July 24, it passed the following resolution, viz:

'RESOLVED, That the members of the International Waterways Commission, have heard with profound regret of the decease of their colleague, George Y. Wisner, Esq., on July 3, at Detroit, Mich. In the death of this eminent engineer the commission has lost an able adviser and a valued associate. Upon the great experience and acquirements of Mr. Wisner the commission always felt it could rely; his fairmindedness it has never doubted, and his devotion to his duties has ever assured his full and able performance of his duties as a commissioner. To his widow and family we extend our most sincere sympathy.

Mr. Wisner's place upon the commission was filled by the appointment of Mr. Eugene E. Haskell, dean of the civil engineering department of Cornell University. The secretary of the American section, Mr. L. C. Sabin, resigned in August to accept the position of superintendent of the Sault Ste. Marie Canal. He was succeeded by Mr. W. E. Wilson.

3. A change occurred also in the Canadian membership. Under date of November 18, 1905, Mr. J. P. Mabee was appointed judge of the Supreme Court of Judicature for Ontario, justice of the High Court of Justice of Ontario, and a member of the Chancery Division of the said High Court of Justice. He was succeeded as chairman of the Canadian section of this commission by George C. Gibbons, Esq., of London, Ontario.

4. The full commission has held eight, and the American section twelve, meetings during the year at Buffalo, Niagara Falls, Toronto, Chicago, and Washington, the sessions lasting from one to three days each. In the intervals between the meetings the collection and study of the data bearing upon the various questions before the commission were continued.

NIAGARA FALLS.

5. A joint resolution was past by Congress, approved March 15, 1906, calling upon the American members 'to report to Congress at an early date what action is, in their judgment, necessary and desirable to prevent the further depletion of water flowing over Niagara Falls; and the said members are also requested and directed to exert, in conjunction with the said members of said commission representing the Dominion of Canada, if practicable, all possible efforts for the preservation of said Niagara Falls in their natural condition.' The American members submitted a report dated March 19, 1906, which was forwarded by the Secretary of War, March 20, 1906, to the President, who submitted it to

Congress with his message of March 27, 1906. It was published as Senate document No. 242, Fifty-ninth Congress, first seesion. It was subsequently concurred in substantially by the Canadian members, and the joint report of the full commission dated May 3, 1906, was forwarded to Congress by the President with his message of May 7, 1906, and was published as Senate document No. 434, Fifty-ninth Congress, first session.

6. The report of March 19 was followed by an exhaustive investigation of the subject by the Rivers and Harbours Committee of the House of Representatives, who, during several weeks, held public hearings in Washington, at which all persons interested were given an opportunity to be heard, and who sent a subcommittee to Niagara Falls, where a thorough inspection of the works was made, and where also there was a public hearing. The result was a confirmation of the report in all essential particulars.

7. An 'Act for the control and regulation of the waters of Niagara River, for the preservation of Niagara Falls, and for other purposes,' approved June 29, 1906, was then passed by Congress. It authorizes the Secretary of War to grant permits for the diversion of water on the American side, and for the transmission of electrical power from Canada, under certain prescribed conditions and to certain prescribed limits. The total amounts authorized being considerably less than the amounts applied for by the power companies, a more detailed investigation, which should embrace particularly the commercial and financial side of the power-producing industry at Niagara Falls, became necessary to ensure an equitable division of the amounts authorized. Capt. Charles W. Kutz, Corps of Engineers, U. S. Army, was detailed by the Honourable Secretary of War to make the investigation. Four kinds of permits are authorized in the law. On the 15th day of August he submitted a report upon permits for the transmission of electrical power to the United States from Canada, which was reviewed by us in our report dated September 29, 1906. On the 5th of October he submitted a report upon permits for the diversion of water on the American side, which was reviewed by us in our report of November 15, 1906.

CHICAGO DRAINAGE CANAL.

8. Any discussion of the preservation of Niagara Falls would have been incomplete without some reference to the Chicago Drainage Canal, which was designed to divert from the southern end of Lake Michigan 10,000 cubic feet per second of water naturally tributary to the falls. A discussion of the effect of such diversion upon water levels, and consequently upon the navigation interests of the Great Lakes and of the St. Lawrence Valley, could find no proper place in the Niagara Falls report. In recommending the allowance of 10,000 cubic feet per second to the Chicago Drainage Canal the commission ignored those important questions. It believed, in so doing, that it was accepting a general tacit agreement that some such amount was required to protect the health of Chicago, and that that city should have it without further question, whatever the effect upon navigation might be. It believed also that the amount was all that Chicago asked or desired. It turns out that in this latter respect it was mistaken. Plans are on foot at Chicago which call for a much larger amount at present and for amounts in the future to which no limit is assigned. The commission has collected a large amount of information upon the subject, and has held public hearings at Buffalo and Chicago, but its investigations are not entirely completed. It will at an early day submit a full report upon the subject.

SAULT STE. MARIE.

9. On the 3rd of May the commission submitted to the two governments a joint report upon the conditions existing at Sault Ste. Marie, in which were the following recommendations, viz:

'1. That no permits shall be granted for the use of the waters of St. Marys river, or for the erection of structures in, under or over, or the occupation in any manner of the said waters until plans have been submitted to the commission for its investigation and recommendation, and the use of the waters under such permits shall not be allowed except upon compliance with the rules hereinafter recommended.

'2. The commission further recommends that no grants, permits, or concessions should be made, which directly or by operation of law, may, in any manner, affect the right of the United States or of Canada to control the bed of the St. Marys river, below high-water mark, and especially that none should be made, which, legally or equitably, may be the means of adding to the expense of acquiring lands or rights for the purpose of making improvements in aid of navigation, or which may give an equitable right to compensation in case of the removal of structures in said river.

'3. That steps be taken to increase the lockage facilities at the Sault Ste. Marie without unnecessary delay.

'4. That the Governments of the United States and Canada reserve all water necessary for navigation purposes, at present or in the future, and the surplus shall be divided equally between the two countries for power purposes.

'5. As the commission regards the interests of the United States and Canada in the preservation of the lake levels, and in the improvement of the channels and the conservation of the water supply for purposes of navigation as identical and as incapable of efficient protection without joint and harmonious action on the part of the two governments, it recommends that the rules hereinafter set forth be adopted, and that a joint commission be created to supervise their enforcement, or that such powers be vested in the existing International Waterways Commission, subject to such restrictions and reservations as may be deemed advisable.'

The report was approved by the honourable Secretary of War and by him transmitted to the honourable Secretary of State with the following endorsement dated May 14, 1906, viz:

'Respectfully referred to the Secretary of State with a request that after the report be read it be forwarded to the President as a basis for negotiations looking to the adoption of a treaty carrying into effect the recommendations of the International Waterways Commission, the report of which is approved so far as this department is concerned.'

Embodied in the report were a series of rules and regulations to govern the use of water at the Sault. As the enforcement of these rules involves the creation of a permanent international commission, they have not as yet been put in force. It is to be presumed that provision for a permanent commission will be arranged in a treaty. A full copy of the report is hereto appended, marked 'A.'

MINNESOTA CANAL AND POWER COMPANY.

10. The Minnesota Canal and Power Company, a corporation organized under the laws of Minnesota, proposes to construct reservoirs in the Birch Lake basin in Minnesota, in which water is to be stored, and from which it is to be released as needed, and conducted by artificial and natural channels southward to Duluth, where it is to be employed for generating electrical power. The natural drainage of the Birch Lake basin is northward into the Rainy river, Lake of the Woods, Winnipeg river, Winnipeg lake, and finally into Hudson bay; the water thus forming a part of the international boundary and finally entering territory which is exclusively Canadian. The company applied to the Department of the Interior for permission to use certain public lands by flowage and otherwise. The attention of the commission was drawn to the matter immediately after its organization, as was stated in our last annual report, but the

commission had at that time doubts about its jurisdiction in the case, inasmuch as the waters were not naturally tributary to the Great Lakes system. This doubt was dispelled by a letter from the honourable Secretary of State to the honourable Secretary of War dated May 14, 1906 (copy appended marked 'B'), in which he requested that the matter be referred to the commission.

11. After several public hearings and a careful examination of all the documents in the case, the number of which is very great, the commission rendered a joint report to the two governments, dated November 15, 1906 (copy appended marked 'C'), in which are the following conclusions, and recommendations, viz:

'1. While the work proposed by the applicant will be of great advantage to the interests served, it will interfere with public and private interests in Canada, and the commission see no public necessity for it.

'2. The proposed diversion will injure the interests of various classes of persons, namely, residents of the United States having property rights in the State of Minnesota, residents of the United States having property rights and interests in Canada and in the boundary waters, residents of Canada having property rights and interests in Canada, and municipalities in the Dominion of Canada. The rights and interests which will be affected are divisible into two classes, namely, those which depend upon navigation directly or indirectly, and those which depend upon the use of waters in the various streams and lakes for power purposes.

'3. The proposed diversion will affect injuriously navigation upon the boundary waters between the United States and Canada, above mentioned, and upon navigable waters in Canada connecting said boundary waters; but,

'4. So far as water-power interests on the international boundary or in Canada are concerned, which depend upon the supply from Birch Lake drainage area, although remedial works at locations above Rainy Lake may be constructed, the total amount of water which can be stored and used for power purposes upon the boundary and connecting waters located wholly in Canada will be diminished.

'5. The applicant, the Minnesota Canal and Power Company, of Duluth, Minn., under the decision of the Supreme Court of Minnesota, above cited, apparently has not the power to utilize the permit it seeks to obtain, but possibly may acquire that power. It would seem, therefore, that the permit which the applicant seeks, ought not in any case to be granted before it secures authority under the laws of Minnesota to utilize it.

'6. That the rights and interests of the residents of Minnesota which may be affected by the proposed diversion, are of so much less importance than the interests which will be promoted by the proposed works of the applicant, that they do not furnish a sufficient reason for refusing the permit sought, inasmuch as full compensation must be made to such persons under the laws of Minnesota.

'7. Neither the State of Minnesota nor the United States can provide adequate means by which money compensation can be ascertained and made to the owners of the interests in Canada which may be injured, and it follows that individuals sustaining injury would be relegated to litigation. This is a violation of the principle of law that private property shall not be taken for public use, unless provision for compensation can be made without litigation and its attendant delays and expense.

'8. So far as remedial works are concerned, it is sufficient to say that there is no jurisdiction in the United States or in the State of Minnesota to provide for or permit the erection of the necessary remedial works in Canada.

'9. That although it might be advisable to grant the permit applied for, in case the applicant should acquire the powers necessary to utilize it, if objections arising from international relations did not exist, treaty provisions, international comity, and the impossibility of providing just means of assuring adequate compensation for injury to interests in Canada, or of preserving navigation unim-

paired on the boundary streams, without concurrent action of both governments concerned, lead us to the conclusion that the permit should not be granted unless the full protection of all interests not cared for by the laws of Minnesota be secured by concurrent action of the United States and Canada.

'1. The commission would therefore recommend that the permit applied for be not granted without the concurrence of the Canadian government.

'2. As questions involving the same principles and difficulties, liable to create friction, hostile feelings, and reprisals, are liable to arise between the two countries, affecting waters on or crossing the boundary line, the commission would recommend that a treaty be entered into which shall settle the rules and principles upon which all such questions may be peacefully and satisfactorily determined, as they arise.

'3. The commission would recommend that any treaty which may be entered into should define the uses to which international waters may be put by either country without the necessity of adjustment in each instance, and would respectfully suggest that such uses should be declared to be:

'(*a*) Use for necessary domestic and sanitary purposes.

'(*b*) Service of locks used for navigation purposes.

'(*c*) The right to navigate.

'4. The commission would also respectfully suggest that the treaty should prohibit the permanent diversion of navigable streams which cross the international boundary or which form a part thereof, except upon adjustment of the rights of all parties concerned by a permanent commission, and with its consent.'

RICHELIEU RIVER AND LAKE CHAMPLAIN.

12. The International Development Company, a corporation organized under the laws of Canada, proposes to deepen the Richelieu river and regulate its flow so that there shall be a uniform discharge of at least 9,000 cubic feet per second throughout the year. For this purpose it proposes to use Lake Champlain as a reservoir, in which the surplus water is to be stored during the wet season, and from which it is to be released as needed during the low-water period. The works are to be located in Canadian territory, but the company, desiring to ascertain the probable attitude toward them of the United States Government, submitted to the War Department a preliminary statement, without plans, showing in general what it proposed to accomplish. The matter was referred to the International Waterways Commission by endorsement of the honourable Secretary of War, dated November 6, 1906. The commission found that a uniform flow of 9,000 cubic feet per second could not be maintained at all seasons and in all years without giving to Lake Champlain a range, between extreme high and extreme low water, which they deemed inadmissible; but that it would be possible to plan works which would not injuriously affect Lake Champlain and would materially improve the conditions of the flow in the Richelieu river.

Under date of November 15, 1906, it submitted a joint report to the two governments (copy appended, marked 'D'), from which the following is an extract, viz:

'As Lake Champlain is wholly within the territory of the United States, and the proposed works are wholly within Canadian territory, the international questions raised are of some moment. It is in our opinion not desirable that either nation should obstruct the natural flow of streams crossing the international boundary to the injury of public or private rights in the other. It is manifest, therefore, that the applicants should furnish conclusive evidence that private rights in the States of New York and Vermont adjoining Lake Champlain will not be injuriously affected by the alteration of the lake level as proposed, and that as the Secretary of War of the United States has control of the interests of navigation on Lake Champlain, the said work should not be undertaken

without his permission, and should be operated under such regulations as he may direct, with a view to the maintenance of the level of the said lake as the interests of navigation thereon may require. It would be impossible to plan works, adapted to the conditions, and in our opinion such works should be permitted, provided they do not interfere with private interests in the United States and meet with the approval of the Secretary of War as suggested. We respectfully submit that in any treaty to be had between the two nations in relation to the use of international waters the principles above suggested should have consideration. We would further suggest that the applicant's Canadian Act of incorporation should be amended, so as to provide that the maintenance of the works sought to be erected shall be conditional at all times upon compliance with all regulations imposed by the Secretary of War of the United States of America from time to time for the preservation of the levels of Lake Champlain.

INTERNATIONAL BOUNDARY IN LAKE ERIE.

13. In August last a large number of nets were placed in Lake Erie by the Keystone Fish Company, of Erie, Pa., near the middle of the lake, but on what they claim is the American side of the boundary. Most of these nets were promptly seized and confiscated by the Canadian vessel *Vigilant*. The commander of the *Vigilant* then proposed to the American fisherman to show them the boundary, and aid them in marking it with buoys, so that they might always remain on their own side of the line if they desired to do so. The proposal was forwarded to the honourable Secretary of State and by him to the honourable Secretary of War, under date of September 5, 1906, with the request that it 'be referred to the International Waterways Commission with the inquiry whether it is known that the American and Canadian charts of the locality agree as to the distance to be logged from the gas buoy at Erie to the boundary line on the usual fishing grounds.'

14. It has been necessary to reduce the various charts upon which the boundary is marked to the same system of projection and the same scale in order to compare them, and this has required much time. The British Admiralty chart and the United States Lake Survey chart are projected on the polyconic system; the hydrographic chart issued by the United States Navy Department is projected upon the Mercator system; while the chart on file in the State Department with the Treaty of Ghent, as near as can be ascertained, is on the plane rectangular system; with one exception, each is of a different scale from any other. It is found that the boundary as laid down on the United States hydrographic chart differs widely from that on the British Admiralty chart. They both derive their authority from the Treaty of Ghent. The map on file with the treaty is so inaccurate that no two persons would probably transfer the boundary line marked thereon to a modern chart in the same way. It is in fact worthless for its purpose. The only guide for the location of the boundary in Lake Erie, except at the eastern and western extremities, is in the expression in the text of the treaty 'through the middle of said lake.' Under that description a variety of lines may be laid down. The commission expects to complete and forward its report upon the subject at an early day.

DETROIT RIVER TUNNEL.

15. The plans of the Detroit River Tunnel Company for the construction of a tunnel under the Detroit river having been referred to the commission, it passed at its session of March 7, 1906, at Toronto, the following resolution, viz:

'That the International Waterways Commission approve of the plans of the construction of a tunnel under the Detroit river prepared by the Detroit River Tunnel Company, and submitted to the commission by the Chief of Engineers of the United States Army under date of February 13, 1906, and by the Minister

of Marine and Fisheries for Canada under date of November 16, 1905, the construction to be carried on on the American side under the regulations contained in the report of the Board of Engineers of the United States Army of date January 26, 1906, and that the same be carried on on the Canadian side under regulations to be fixed by the Minister of Public Works and the Minister of Marine and Fisheries.

SUMMER RESORT NEAR LONG SAULT RAPIDS.

16. Under date of May 28, 1906, Mr. Smith L. Dawley, of Ogdensburg, N. Y., addressed a letter to the Honourable Secretary of War (copy appended, marked "E") applying for permission to construct dikes, retaining walls, and such other structures in the River St. Lawrence near Long Sault Island as should be necessary to create an 'attractive summer resort with navigable approaches thereto and the development of a water power.' By endorsement dated June 2, 1906, the paper was referred to the Commission. It was not accompanied by any plans, but had with it a rough sketch upon a small-scale chart, with a meagre written description which did not conform to the chart. The Commission not having information at hand sufficiently to justify a recommendation, promptly notified Mr. Dawley of the deficiency and requested him to provide it with a complete description of his plans. This has not as yet been done.

BUFFALO INLET PIER.

17. At its session in Buffalo on the 26th of June representatives of the city appeared before the Commission, and requested its approval of the location of a new inlet pier for the city waterworks, which it was desired to place in the international waters on the Canadian side of the boundary. Although the question had not been regularly brought before it by higher authority, the Commission thought it proper, with a view to avoiding delay, to pass the following resolution, viz:

'That in the opinion of the International Waterways Commission, the tunnel and inlet pier proposed to be constructed in Lake Erie by the City of Buffalo, for the purpose of furnishing a pure water supply to the city, can be built without injury to navigation or other public interests, and it is recommended that permits for the construction of these works be granted, with the proviso that the inlet pier be kept properly lighted at night at the expense of the city.

MASSENA WATER-POWER COMPANY.

18. Under date of April 4, 1906, The Calvin Company, Limited, addressed a letter to the Minister of Public Works of Canada, protesting against the closure by a dam of the south channel at Long Sault Island, which it understood was contemplated by an American corporation. This letter was referred to the Commission. A work such as that described could not be constructed without permission from the War Department of the United States. It was found that no permit had been granted, and that no application for one was at that time pending.

REGULATION OF LAKE ERIE.

19. Much study has been given to this important problem, but the Commission is not as yet prepared to report upon it. A large amount of new data has recently been collected by the office of the United States Lake Survey at Detroit, of which a careful study is necessary to a proper solution of the question.

LEGISLATION SUGGESTED.

20. Under the law of Congress creating the Commission, its jurisdiction is limited to the waters whose natural outlet is by the River St. Lawrence to the Atlantic Ocean. The Canadian government has from the beginning desired that the commission should consider all questions which may arise concerning

the international waters from the Atlantic to the Pacific. To enable the American members to do this, further legislation by Congress is necessary. It would seem proper to comply with the wishes of the Canadian government in this respect.

Yours very respectfully,

O. H. ERNST, Chairman.
GEORGE CLINTON, Member.
E. E. HASKELL, Member.

Hon. WM. H. TAFT,
Secretary of War, Washington, D. C.

APPENDIX 'A.'

REPORT upon the conditions existing at Sault Ste. Marie, with rules for the control of the same, recommended by the International Waterways Commission. (See page 341.)

APPENDIX 'B.'

DEPARTMENT OF STATE,
WASHINGTON, May 14, 1906.

SIR: I have the honour to inclose herewith copy of a letter from the Secretary of the Interior with reference to correspondence had with this Department relative to the application of the Minnesota Canal and Power Company for right of way privileges in the State of Minnesota, under the provisions of the Act of February 15, 1901 (31 Stat., 790.)

Inviting attention to the second paragraph of Mr. Hitchcock's letter, I have the honour to request that the matter be referred to the International Lake Levels Commission for an expression of its views.

I have the honour to be, sir, your obedient servant.

ELIHU ROOT.

The Honourable The Secretary of War.

APPENDIX 'C.'

REPORT of the International Waterways Commission upon the application of the Minnesota Canal and Power Company, of Duluth, Minn., for permission to divert certain waters in the State of Minnesota from the boundary waters between the United States and Canada. (See page 354.)

APPENDIX 'D.'

REGULATING works in the Richelieu river. (See page 351.)

APPENDIX 'E.'

APPLICATION of Smith L. Dawley. (See page 396.)

SESSIONAL PAPER No. 19a

REPORT OF THE AMERICAN SECTION ON THE PRESERVATION OF NIAGARA FALLS.

Message from the President of the United States, transmitting the Report of the American Members of the International Waterways Commission, with letters from the Secretary of State and the Secretary of War, including Memoranda regarding the Preservation of Niagara Falls.

March 27, 1906.—Read; referred to the Committee on Foreign Relations and ordered to be printed.

To the Senate and House of Representatives:

I submit to you herewith the report of the American members of the International Waterways Commission regarding the preservation of Niagara Falls. I also submit to you certain letters from the Secretary of State and the Secretary of War, including memoranda showing what has been attempted by the Department of State in the effort to secure the preservation of the falls by treaty.

I earnestly recommend that Congress enact into law the suggestions of the American members of the International Waterways Commission for the preservation of Niagara Falls, without waiting for the negotiation of a treaty. The law can be put in such form that it will lapse, say in three years, provided that during that time no international agreement has been reached. But in any event I hope that this nation will make it evident that it is doing all in its power to preserve the great scenic wonder, the existence of which, unharmed, should be a matter of pride to every dweller on this continent.

THEODORE ROOSEVELT.

The WHITE HOUSE, March 27, 1906.

DEPARTMENT OF STATE, WASHINGTON, March 24, 1906.

DEAR MR. PRESIDENT,—I return the letter of the Secretary of War with the report of the American members of the International Waterways Commission, regarding the preservation of Niagara Falls.

I think the legislation recommended by the commission would be very useful.

Faithfully yours,

ELIHU ROOT.

WAR DEPARTMENT, WASHINGTON, March 20, 1906.

MY DEAR MR. PRESIDENT,—I herewith transmit, for submission by you to Congress, the report of the American members of the International Waterways Commission, made by them in accordance with the joint resolution approved March 15, 1906, and set out in their report. The recommendations of the commission of legislation necessary and desirable to prevent the further depletion of water flowing over the Niagara Falls suggests the question whether such legislation is within the limitations of the legislative power of Congress, when applied to non-navigable parts of a stream which is within the borders of a state and which is only partly navigable, if the use of the water to be inhibited does not affect navigation in the navigable part of the stream below. It would seem that the treaty power exercised by the President and Senate with respect to a stream which forms the boundary between this country and another, would be subject to less limitation in this regard than the legislative power of Congress, and therefore that it might be more advisable to effect the result sought by Congress through a treaty than through a statute.

Very respectfully,

The PRESIDENT. W. H. TAFT,

Secretary of War.

Report of the American Members of the International Waterways Commission Regarding the Preservation of Niagara Falls.

International Waterways Commission,
Office of Chairman American Section,
Washington, D.C., March 19, 1906

Sir,—1. The American members of the International Waterways Commission have the honour to submit for transmittal to Congress this report, in compliance with the following joint resolution approved March 15, 1906:—

'Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the members representing the United States upon the International Commission created by section four of the River and Harbour Act of June thirteenth, nineteen hundred and two, be requested to report to Congress at an early day what action is in their judgment necessary and desirable to prevent the further depletion of water flowing over Niagara Falls; and the said members are also requested and directed to exert, in conjunction with the members of said commission representing the Dominion of Canada, if practicable, all possible efforts for the preservation of the said Niagara Falls in their natural condition.'

2. The surplus waters of Lake Erie are discharged through the Niagara river into Lake Ontario, the mean level of Lake Erie being 572·86 feet and that of Lake Ontario being 246·61 feet above the sea. Leaving Lake Erie at Buffalo, the river is navigable and flows with a moderate slope to a short distance below Welland river, or Chippewa creek, about 19 miles, in which distance it has a fall of about 14 feet. The slope here is suddenly increased and the river ceases to be navigable. In the next half mile it has a fall of about 50 feet, forming the rapids above the falls. It is divided by Goat Island into two arms of unequal size, that on the Canadian side carrying about seven times the volume of water carried by that on the American side. At the foot of Goat Island the waters of both arms plunge over a vertical precipice, constituting Niagara Falls proper, that on the Canadian side being usually known as the Horseshoe Fall, and that on the American side as the American Fall. The height of the Horseshoe Fall is about 161 feet, and that of the American Fall 165 feet. Immediately below the falls the river is again navigable for a short distance, and then assumes the character of rapids as far as Lewiston, 7 miles from Lake Ontario, where it again becomes navigable and remains so until it enters the lake.

3. The volume of water flowing varies with the level of Lake Erie, which level is subject to variations of several feet, depending upon the rainfall, barometric pressure, and direction and force of the wind. At the mean level of the lake (elevation 572·86) the volume of discharge is 222,400 cubic feet per second. At a very low stage (elevation 571) the volume is 180·000 (see Annual Report, Chief of Engineers, U.S. Army, for 1900, p. 5361. For short periods in midwinter or with prolonged adverse winds, it has sometimes been even less.

4. It is the great volume of water in the falls themselves and in the rapids which makes the place unique. The tremendous display of power in wild turbulence fascinates the mind, and gives to the question of Niagara's preservation a national interest.

5. The local authorities on both sides of the river have recognized their responsibilities in this matter, but have taken somewhat different views as to what these responsibilities are. As long ago as 1883 the state of New York provided for the acquisition of the lands in that state adjoining the falls, with a

view to creating a public park, and in 1885 it declared that these lands 'shall forever be reserved by the state for the purpose of restoring the scenery of the falls of Niagara to and preserving it in its natural condition, they shall forever be kept open and free of access to all mankind without fee, charge or expense to any person for entering upon or passing to or over any part thereof.' A commission of five was created to carry out the purposes of the Act. The state reservation now includes 412 acres, part of which is under water, and an annual appropriation of some $25,000 is made for its care and maintenance. The commission has no jurisdiction beyond the limits of the reservation, but it has never throughout its existence failed to protest and bring all its influence to bear against the depletion of the falls by the abstraction of water above and beyond the limits of the reservation. Nevertheless, the state legislature has granted numerous franchises for the diversion of water, as will appear further on.

6. Soon after the creation of the New York state reservation a public park was created on the Canadian side, called the Queen Victoria Niagara Falls Park, and was placed under the control of five commissioners. This park now extends practically the whole length of the Niagara river from Lake Erie to Lake Ontario, and embraces an area of about 734 acres. By an Act of the Ontario legislature (62 Victoria, cap. 11), it was enacted that 'the said commissioners, with the approval of the lieutenant-governor in council, may enter into an agreement or agreements with any person or persons, company or companies, to take water from the Niagara river or from the Niagara or Welland rivers at certain points within or without the said park for the purposes of enabling such person or persons, company or companies, to generate within or without the park electricity, or pneumatic, hydraulic or other power conducting or discharging said water through and across the said park or otherwise in such manner, for such rentals, and upon such terms and conditions as may be embodied in the agreement or agreements and as may appear to the lieutenant-governor in council to be in the public interest.' In 1903 this Act was amended by adding thereto the words 'but no such agreement shall be operative unless and until ratified and confirmed by the legislative assembly' (3 Edward VII., chap. 7). Inasmuch as the park receives no aid from the legislature in the way of annual appropriations for its support, the commissioners have felt justified in using with some freedom the power thus granted in order to obtain a revenue for the general improvement and maintenance of the park. Prior to the amendment of 1903, they entered into four important agreements for the diversion of water, and caused an investigation to be made as to the availability of additional sites for power works Two of these agreements were with a single corporation, which has thus far utilized only one.

7. The great water power available at Niagara Falls naturally attracted the attention of engineers at an early day, but it was not until it could be transmitted and used in the form of electricity that its development on a large scale became financially practicable. There are now five principal corporations engaged in furnishing or preparing to furnish electricity for commercial purposes, obtained from the water-power, two of them located on the American and three on the Canadian side. A brief description of each is here given. A map showing their location is submitted herewith. (See page 454). It is to be remarked that none of the diversions have been sanctioned by the United States government.

8. *I. Niagara Falls Hydraulic Power and Manufacturing Company.*—This company was organized in 1877 under the general laws of the state of New York. It purchased a canal which had been constructed before the civil war, leading from Port Day, above the falls, through the city of Niagara Falls, to the edge of the cliff below the falls, where a grist mill had been established, The length of this canal was about 4,400 feet, its width 36 feet, and its depth 8 feet. A width of 70 feet and depth of 10 feet had been projected. In 1881 the company established its first station for supplying electricity for lighting, this

being the first public distribution for commercial purposes of electricity derived from Niagara Falls. The increasing demand for electricity and the improved methods of transmitting it led to a steady development of the works of this company and to the establishment of others. In 1895 an important enlargement of the canal having been begun, the right of the company to take water from the river was questioned by the commissioners of the state reservation at Niagara. An opinion was obtained from the attorney general of the state of New York (copy appended marked 'A') in which it was held that the Niagara river is a navigable river in law, that the company had no right to increase the capacity of its canal, that it had no right to divert any water from the river, and that a diversion of water sufficient to diminish the flow over the falls was a nuisance and could be restrained.

The New York legislature thereupon passed an Act (chap. 968, laws of 1896), in which the right of the company 'to take, draw, use, and lease and sell to others the use of the waters of Niagara river for domestic, municipal and sanitary purposes,and to develop power therefrom for its own use and to lease and sell to others it use for manufacturing, heating, lighting and other business purposes, is hereby recognized, declared and confirmed.' No limit as to the time during which these rights were to exist was fixed, but the amount of water to be taken was limited to that which could be drawn by a canal 100 feet wide, with such depth and slope as would maintain at all times a depth of 14 feet. The amount of water thus described is not specific. It is computed to be about 9,500 cubic feet per second for the works now under construction, but it would be possible to construct works under different plans which would use a much greater quantity of water. The company is now using about 4,000 cubic feet per second. It is extending its works, and expects to develop about 134,000 horse-power, in addition to which its tenant companies will develop about 8,000 horse-power. It has paid nothing to the state for its privileges. A list of the more important industries which this company supplies with electricity is given in Appendix B. Its managers estimate that the power plant and the industries dependent upon it for power represent an investment of $10,000,000.

9. *H. Niagara Falls Power Company.*—In 1886 the New York legislature granted a charter to a company called the 'Niagara River Hydraulic Tunnel Power and Sewer Company of Niagara Falls,' subsequently amended in 1886, 1889, 1891, 1892 and 1893. (See chapter 83, 1886; chapter 489, 1886; chapter 109, 1889; chapter 253, 1891; chapter 513, 1892; chapter 477, 1893.) In 1889 the name of the company was changed to 'The Niagara Falls Power Company.) It is authorized to take water sufficient to generate 200,000 horse-power, computed to be about 17,200 cubic feet per second. Its franchise is for fifty years from March 31, 1886. The location of its works is shown upon the map. Beginning about a mile above the falls a short intake canal is constructed nearly at right angles with the river shore. Upon each side of the canal deep pits are excavated in the rock, at the bottom of which are placed the turbines, and over which are placed the power-houses. The water, after passing through the turbines, is carried off by a tunnel about 21 feet in diameter under the city of Niagara Falls to the lower river, a distance of about 7,000 feet. The company has in operation two power-houses having a combined capacity of about 105,000 horse-power.

It is working the plant nearly to its full present capacity, using about 8,000 cubic feet per second, in addition to which one of its tenant companies is using about 600 cubic feet. It paid nothing to the state for its privileges but is bound to furnish free of charge electricity for light and for power and also water for the use of the state in the state reservation at Niagara and the buildings thereon, when requested to do so by the commissioners of the state reservation. It distributes electric power over a wide area of territory and to a great variety of commercial interests in Niagara Falls, Tonawanda, Olcott, and Buffalo, in

some cases over 35 miles distant. A list of the consumers dependent upon this company is given in appendix C. The investment is stated by the managers to be over $6,000,000 in the power plant, and $7,000,000 or $8,000,000 in other industries established on its hands at Niagara Falls and dependent upon it.

10. *III. Canadian Niagara Power Company*—This company is an allied company of the Niagara Falls Power Company just described. It was incorporated by an act of the legislature of the province of Ontario in 1892, which also confirmed an agreement dated April 7, 1892, between the company and the commissioners for the Queen Victoria Niagara Falls Park. In 1899 an Act was passed conferring upon those commissioners authority to modify this agreement and to make other agreements for the construction of power works, as specified above. The agreement was modified July 15, 1899, and June 19, 1901.

11. The company is authorized to construct certain works, which works will have a capacity of 110,000 horse-power, and by inference to take the quantity of water required for that purpose, although the agreement does not in terms limit the capacity of the works or the quantity of water. The amount required to supply the works which have been approved and are under construction is computed to be about 9,500 cubic feet per second. The location of the works is shown upon the map. They are of the same general type as those of its allied company on the American side. Water is taken from the river about a quarter of a mile above the falls through a short canal and fore bay and discharged through penstocks into turbines near the bottom of a deep wheel pit excavated in the solid rock, over which is placed the power-house. After passing through the turbines, the water is carried off by a tunnel about 2,000 feet long, and discharged into the river below the falls. The works are not completed, and less than half of the generators have been installed, the quantity of water used thus far being about 2,600 cubic feet per second. They are operated in connection with those of the allied company on the American side. They represent an investment of several million dollars.

12. The company agrees to pay for its privileges an annual rental of $15,000, for which it may generate 10,000 electrical horse-power or less; for all above 10,000 and under 20,000 horse-power it pays in addition to the above $1 per annum for each horse-power; for all above 20,000 and under 30,000 it pays a further sum of 75 cents per annum for each horse-power; and for all above 30,000 it pays a still further sum of 50 cents per annum for each horse-power; that is to say, the annual rental for generating 30,000 horse-power will be $32,500, and for generating 110,000 horse-power will be $72,500.

13. The period for which the privileges are granted is fifty years from May 1, 1899, but the company is entitled, at its option, to three renewals of twenty years each, the rentals to be adjusted at the time of each renewal ,if the lieutenant-governor in council so desires, and at the end of the third renewal the lieutenant-governor in council may require a still further renewal of twenty years; the entire period thus covered by the agreement being one hundred and thirty years.

14. *IV. Ontario Power Company*—This company was incorporated by an Act of the Dominion Parliament in 1887, and was empowered to take water from the Welland river, or Chippewa creek, near its mouth at Chippewa—that is, indirectly from the Niagara river. On the 11th of April, 1900, it entered into an agreement with the park commissioners to construct works for that purpose, but before progressing far in the work of construction it changed its plans, and on the 28th of June 1902, it made another agreement with the commissioners, under which it is now working. It claims that the first agreement is still valid and may be utilized hereafter if the company so desires. Under the agreement of June 28, 1902, the company is authorized to construct works according to certain plans submitted, which works will have a capacity of

180,000 horse-power, and by inference to take the quantity of water required for that purpose, although the agreement does not in terms limit the capacity of the works or the quantity of water. The amount required to supply the works, which have been approved and are under construction, is computed to be about 12,000 cubic feet per second. The location of the works is shown upon the map. Water is taken from the river at Dufferin Island, about half a mile above the intake of the Canadian Niagara Power Company, or three-quarters of a mile above the falls, and after passing through an elaborate system of screens enters a gatehouse and there is transmitted through three underground conduits, each 18 feet in diameter, to a power-house located near the foot of the cliff below the falls. The length of the pipe line to the nearest penstock is 6,180 feet, and to the most distant penstock about 1,000 feet more. The works which represent an investment of several million dollars, are not completed, only about 2,000 cubic feet per second now being used.

15. The company agrees to pay for its privileges an annual rental of $30,000, for which it may generate 20,000 electrical horse-power or less. For all above 20,000 and under 30,000 horse-power it pays, in addition to the above, $1 per annum for each horse power; for all above 30,000, and under 40,000 it pays a further sum of 75 cents per annum for each horse-power, and for all above 40,000 it pays a still further sum of 50 cents per annum for each horse-power; that is to say, the annual rental for generating 40,000 horse-power will be $47,500, and for generating 180,000 horse-power will be $117,500.

16. The period for which the privilege is granted is fifty years from April 1, 1900, but the company is entitled, at its option, to three renewals of twenty years each, and after the third renewal the lieutenant-governor in council may require a fourth renewal of twenty years, the rentals to be adjusted at each renewal, the entire period thus covered by the agreement being 130 years.

17. *V. Electrical Development Company.*—On the 29th January, 1903, the commissioners for the Queen Victoria Niagara Falls Park entered into an agreement with three citizens of Canada, subsequently transferred to 'The Electrical Development Company of Ontario (Limited)', incorporated by Act of the legislature of Ontario. (5 Edward VII., chap. 12.) Under this agreement authority was given to take from the Niagara river, water sufficient to develop 125,000 electrical horse-power. The amount computed to be 11,200 cubic feet per second. The location of the works is shown upon the map. Water is taken from the river about midway between the intakes of the Canadian Niagara Power Company and of the Ontario Power Company, or about half a mile above the falls. A gathering dam, about 750 feet long, extends out into the river obliquely upstream, designed to divert the required amount of water into the power-house, which is located upon the original shore line. Under the power-house is a wheel pit, excavated in the solid rock to a depth of 158 feet, at the bottom of which are placed the turbines. After passing through the turbines the water is covered by a tunnel to the base of the falls and discharged about midway between the Canadian and American shores. The works are not completed, and no water is now being used. They represent an investment of several million dollars.

18. The company agrees to pay for its privileges an annual rental of $15,000, for which sum it may generate 10,000 electrical horse-power or less; for all above 10,000 and less than 20,000 horse-power it pays, in addition to the above, $1 per annum for each horse-power; for all above 20,000 and less than 30,000 it pays a further sum of 75 cents per annum for each horse-power; and for all above 30,000 it pays a still further sum of 50 cents per annum for each horse-power; that is to say, the annual rental for generating 30,000 horse-power will be $32,500, and for generating 125,000 horse-power will be $80,000.

19. The period for which the privilege is granted is fifty years from February 1, 1903, but the same provisions are made for renewals as in the cases

of the other companies, and the entire period covered by the agreement is thus one hundred and thirty years.

20. In the case of each of the Canadian companies the authorities reserve the right to require that one-half the power generated shall be supplied to places in Canada.

21. Water is diverted also by the Park Electric Railway under authority of the commissioners, the quantity to be used under plans, now in execution being estimated at 1,500 cubic feet per second, developing about 8,000 horse-power, while the actual present use is about 600 cubic feet per second.

22. In addition to the foregoing, six charters were granted by the New York legislature between the years 1886 and 1894 to corporations organized to take water from the Niagara river, but it is believed that all, with the possible exception of two, have expired by limitation. In one case, the Niagara, Lockport and Ontario Power Company, an act to renew its charter passed the legislature in 1904, but was vetoed by Governor Odell in his message of May 14 of that year. The company, however, claims the rights granted under its original charter, and is constructing works for the distribution of electrical energy developed by other companies, but is not itself diverting water. Another Corporation, the Niagara County Irrigation and Water Supply Company, has done some work, and claims that its charter has thus been preserved, but it has diverted no water. A list of these charters is given in Appendix D.

23. The Dominion of Canada has granted charters to two corporations in addition to those already mentioned, organized to take water from the Niagara river for power purposes. It has chartered two other corporations, organized to take for power purposes water from Lake Erie, which would naturally be tributary to the Niagara river. These companies have not finally developed their plants, and it is believed that their franchises are therefore not perfected, although all but one are still in force. In one case the charter has expired by limitation. The charters fix no limit to the amount of water which may be used. A charter was granted in 1889 by the province of Ontario to the Hamilton Cataract, Power, Light and Traction Company. This company is using water from the Lake Erie level of the Welland Canal, which water would otherwise be tributary to the Niagara River. The volume now being used is estimated at about 1,800 cubic feet per second, and is to be increased. A list of these charters will be found in Appendix E.

24. The Chicago Drainage Canal, constructed under the authority of the State of Illinois, was designed to divert about 10,000 cubic feet per second of water which would naturally flow over Niagara Falls. It has not been fully completed, but it now has a capacity of about 5,000 cubic feet per second. The amount which it is actually diverting has thus far been limited by the Secretary of War to about 4,200 cubic feet per second. In addition to the foregoing about 333 cubic feet per second of Lake Erie water is now taken for power purposes from the Erie Canal at Lockport.

25. Full and precise information concerning the plans and legal rights of the companies which have not begun or completed their works has not been obtainable. In the cases of the corporations now furnishing or preparing to furnish electricity for commercial purposes, the franchises are vague as to the volume of water to be used, which is the feature of greatest interest here. We have computed the volumes from the available data, and have endeavoured to make the figures conservative. It must be understood that these figures are fair approximations. In proceeding to an examination of the effect upon Niagara Falls of the works proposed, the subject is much simplified by considering only those companies which derive their water from the Niagara river itself, and that is the course here pursued. Any effects caused by these works will be exaggerated by the other works mentioned.

26. The total quantity of water to be taken from the river by works now authorized is:

	Cubic Feet.
Niagara Falls Hydraulic Power and Manufacturing Company	9,500
Niagara Falls Power Company	17,200
Canadian Niagara Power Company	9,500
Ontario Power Company, not including Well and River Development	12,000
Electrical Development Company	11,200
Niagara Falls Park Railway Company	1,500
Total	60,900

Of this amount 26,700 cubic feet is to be taken on the American side and the remainder, 34,200 cubic feet, on the Canadian side. That is, 27 per cent of the average discharge and 33 per cent of the low-water discharge of the Niagara river will cease to pass over the falls when these works are completed and in full operation. The quantity to be diverted is more than double the quantity which now passes over the American falls, which at the average stage is about 27,800 cubic feet. That this will in general hac ean injurious effect upon the falls seems self-evident. The volume of water to be diverted is about the equivalent of the entire discharge of Lake Superior over the Sault Ste. Marie. The amount thus far actually diverted is but 17,800 cubic feet per second, and has had an appreciable effect upon the falls. To foretell with accuracy the effects in details of the full diversion authorized would require a more complete knowledge of the bed of the river than is now obtainable. The water taken on the Canadian side below the crest of the rapids will affect the Horseshoe Fall alone. If all that taken on the American side should affect the American Fall alone, it would practically leave it dry; but it seems probable that only a part of this diversion will be at the expense of the American Fall.

Exactly what portion that will be can not be stated with precision, but from a study of the channels and reefs, so far as they are known, a reasonable estimate is that the water would come from the two arms in about the proportion of one-sixth from the American Fall and five-sixths from the Horseshoe Fall. Exactly what form the changes in the two cataracts will take, whether they will be made narrower, or be broken up into a greater number of streams or simply be reduced in volume, retaining in general their present form, can not now be foretold, for the reason that there is no accurate knowledge of the form of the bed and depth of water on the crests. If 60,900 cubic feet per second be diverted, the loss will be important, but if the diversion be limited to this amount, or reduced, as hereafter indicated, it may not prove disastrous. This can not be definitely determined until the works now under construction have been completed and put in operation. When that happens, if it be found that the falls have not suffered serious damage, as a scenic spectacle, it does not follow that additional water may be diverted with impunity. Additional diversion would be an experiment even more dangerous than that now being tried, and in our opinion should not be permitted.

27. In return for the impairment of the falls thus far authorized the state of New York will receive practically nothing for the 342,000 horse-power authorized on that side, and the Queen Victoria Niagara Falls Park will receive an annual rental of $270,000 or an average of 65 cents per horse-power for the 415,000 horse-power authorized on the Canadian side. These figures do not include the 8,000 horse-power being developed by the electrical railway not the power developed by the Hamilton Company with water from the Welland canal,

28. If all the water and all the head from the top of the upper rapids to the foot of the falls could be utilized, there would result over 4,000,000 mechanical horse-power. Probably space could be found, if desired, for works which would utilize about half of this, or, say, 2,000,000 horse-power, or possibly more. As they could not utilize all the head, they would use much more than half the water. It will require time to create a market for all this power, but it is reasonably certain that it will in due season be found if the development of the power itself is to go on unchecked. The difierence in cost in favour of falling water over any other method of developing power is so great that all other methods are sure to be abandoned where sufficient water power is available. The difference at Niagara Falls is probably not less than $15 or $20 per annum per horse-power. The cost of transmission to distant points increases with the distance, and finally becomes so great as to be unprofitable; but electrical engineers are engaged in improving the methods and reducing the cost. An average difference of cost for each horse-power cannot now be given with any close degree of approximation, but the difference, whatever it is, is a perpetual annual saving, which, if capitalized, will show that the commercial value of the power at Niagara Falls is very great and is to be measured by the hundred millions of dollars.

29. Whether this commercial asset shall be utilized to such an extent as to seriously impair the majesty and scenic beauty of the falls depends upon the public will. In our opinion the commercial advantages of a large increase in development of power will not compensate for the great loss to the world, of the inspiration, æsthetic education, and opportunity for recreation and elevating pleasure which the mighty cataract affords. The direct advantages to the public from revenue is nothing on the New York side of the river, and comparatively slight on the Canadian side. There is of course an indirect advantage due to added taxable wealth and reduction in the cost of power, but these advantages are, in our opinion, slight in comparison with those which spring from the preservation of the beauty and majesty of the falls in their natural condition. Over 800,000 people visit the falls annually, deriving pleasure and inspiration from them. The nations of the world have always recognized the great value of parks and reservations, and throughout the civilized world they have preserved places of natural grandeur and beauty and furnished parks, artificially beautified for rest, education and the elevation of their people. An illustration may be given in the case of the city of New York one of many hundreds. There the municipality has acquired in Central Park, property which is estimated to be worth $225,000,000, and has spent millions upon its improvement and ornamentation. The United States government has reserved lands of striking picturesqueness, grandeur and interest, regardless of their value. These illustrations would seem to prove conclusively that the people are not inclined to offset mere commercial values against the intangible but none the less great advantages found in the preservation of the great works of nature.

30. It is probably not expedient to attempt the recovery of the rights granted to companies which have taken full advantage of them. In the case of the Niagara Falls Power Company, on the American side, the franchises authorize it to develop 200,000 horse-power. It has constructed works having about half that capacity, but has not begun the construction of the additional works, and we believe has no present intention of doing so. In the case of the Ontario Power Company on the Canadian side, the construction of works under the agreement of April 11, 1900, has been indefinitely postponed. The authority for the additional works in both these cases could probably be withdrawn without inflicting an unreasonable hardship. All franchises of which advantage has not been taken should be extinguished.

31. The following is a summary of the foregoing statement of facts:—

(*a*) The glory of Niagara Falls lies in the volume of its water rather than in its height, or in the surrounding scenery.

(*b*) Works are now authorized and partially completed at the falls which will divert from the Niagara River above the falls about 27 per cent of the average discharge, and about 33 per cent of the low-water discharge, which is more than double the quantity now flowing over the American Fall. In addition to this, water naturally tributary to the Niagara river, is being diverted through the Chicago drainage canal, and for power in addition to navigation purposes through the Erie and the Welland canals.

(*c*) The effect of this withdrawal of water is to injure both the American and the Horseshoe falls in nearly equal proportions. While the injury will be perceptible, it may be not destructive or disastrous.

(*d*) Improvements in the transmission of electric power and increased demand will make a market for all the power which can be developed at Niagara Falls, and will cause a destruction of the falls as a scenic spectacle if the development be allowed to go on unchecked.

(*e*) Charters have been granted to corporations which propose to divert additional amounts in quantities not now limited.

(*f*) The sums of money invested, or being invested, in the works now in operation or under construction, and in the industries dependent upon them, amount to many millions of dollars. It is probably not expedient to attempt the withdrawal of the rights thus utilized.

(*g*) The commercial value of the water power at Niagara Falls is very great, but if compared with values set aside by wealthy communities elsewhere for park purposes this value is not too great to be devoted to similar purposes. The place is visited annually by about 800,000 people.

32. If the falls are to be preserved it must be by mutual agreement between the two countries. As a step in that direction we recommend that legislation be enacted which shall contain the following provisions, viz:—

(*a*) The Secretary of War to be authorized to grant permits for the diversion of 28,500 cubic feet per second, and no more, from the waters naturally tributary to Niagara Falls, distributed as follows:

	Cubic Feet.
Niagara Falls Hydraulic Power and Manufacturing Co.	9,500
Niagara Falls Power Company	8,600
Erie Canal or its tenants (in addition to lock service)	400
Chicago drainage canal	10,000

(*b*) All other diversion or water which is naturally tributary to Niagara Falls to be prohibited, except such as may be required for domestic use or for the service of locks in navigation canals.

(*c*) Suitable penalties for violation of the law to be prescribed.

(*d*) The foregoing prohibition to remain in force two years, and then to become the permanent law of the land, if, in the meantime, the Canadian government shall have enacted legislation prohibiting the diversion of water which is naturally tributary to Niagara Falls, in excess of 36,000 cubic feet per second not including the amounts required for domestic use or for the service of locks in navigation canals. It is assumed, however, that an understanding upon this subject would be reached by treaty.

33. The object of such legislation would be to put a stop to the further depletion of the falls, and at the same time inflict the least possible injury upon the important interests now dependent upon this water power. The amount to be diverted on the Canadian side has been fixed with a view to allowing to the companies on that side the amounts for which they now have works under construction, which are:

	Cubic feet.
Canadian Niagara Power Company	9,500
Ontario Power Company	12,000
Electrical Development Company	11,200
Niagara Falls Park Railway Company	1,500
Welland Canal or its tenants (in addition to lock service)	1,800

34. One of the effects of such legislation would be to give to Canada the advantage of diverting 7,500 cubic feet per second more than is diverted in the United States. The advantage is more apparent than real, since the power generated on the Canadian side will to a large extent be transmitted to and used in the United States. In the negotiation of a treaty, however, the point should be considered

35. The substance of this report was submitted to our Canadian colleagues before the passage of the joint resolution, with a view to uniting in a joint report under the general law providing for the commission. There was a substantial agreement in the statement of facts, and such differences as developed with respect to the recommendations which ought to be made did not seem unsuperable, but our colleagues desired time for further consideration. We have no doubt of their sympathetic interest in carrying out that part of the instructions contained in the resolution which requires us 'to exert in conjunction with the members of said commission representing the Dominion of Canada, if practicable, all possible efforts for the preservation of Niagara Falls in their natural condition.'

Very respectfully,

O. H. ERNST,
Colonel, Corps of Engineers, Chairman.

GEORGE CLINTON,
Member, Amejican Section

GEO. Y. WISNER,
Member, American Section.

THE SECRETARY OF WAR,
Washington, D.C.

APPENDIX A.

STATE OF NEW YORK,
ATTORNEY-GENERAL'S OFFICE,
ALBANY, November 16, 1895.

DEAR SIR,—Some time ago the question of the right of the Niagara Falls Hydraulic Power and Manufacturing Company to enlarge the capacity of their canal, by which a portion of the water of the Niagara river is diverted for manufacturing purposes, was submitted to me for examination by you. The question is one involving great interest, not only to the corporation referred to, but to the state itself, and I have therefore considered it with a great deal of care before venturing to express an opinion.

The facts in the case may be briefly stated. The canal in question was originally constructed in the year 1859. Its dimensions were 70 feet wide by 14

feet deep. The inlet is at Port Day, about 1 mile above the falls, and it runs through a strip of land 100 feet wide to the mills on the bank of the river below the falls, where the waters, after supplying power to various industries, are discharged into the river.

About the year 1878 the title to the land in the 100-foot strip, as I am informed by Mr. Schoelkopf, of Niagara Falls, was acquired by the present owners, since which time the canal has been in active operation, and has supplied power to mills of a sufficient capacity to employ a large number of hands, residents of the city of Niagara Falls, and whose continued prosperity, to a very large degree, is dependent upon the operation of the mills in which they are employed. Some time after the acquisition of title to the strip of land by the present owners they made application to the land commissioners of the State of New York for a grant of land under water adjoining the inlet to the canal.

In the papers submitted on that application it was stated to be the intention of the owners to increase the capacity of the canal, and thereby increase its production of horse-power. The grant was made by the commissioners with the condition that no structures were to be built upon the granted land without the consent of the Niagara Reservation Commission. Thereafter application was made to the reservation commission for leave to erect cribs on the land under water, the purpose of which was to prevent the flow of ice and other refuse into the canal, to the detriment of the interests of the Niagara Falls Hydraulic Power and Manufacturing Company.

The capacity of the canal at that time, if I am correctly informed, was 200,000 cubic feet per minute. No objection was made (at least publicly) to this diversion of the waters of the river at that time. Since then, however, various grants of privileges by the legislature of the State have been given to several corporations to divert the waters of the Niagara River for power purposes. In consequence of these grants apprehension has been created as to the probable effect upon the flow of water over the falls, and your commission, actuated by commendable zeal to protect the great natural beauty of the resevation, have determined that further encroachments upon the stream shall be prevented, if possible.

The law under which your board was created (chap. 336, Laws of 1883) states that the object of the creation of the commission was to preserve the scenery of the Falls of Niagara. It provides for the condemnation of the lands to be selected by the commission, and for the compensation to be paid to the owners of the property condemned. In carrying out the provisions of the law several million dollars have been expended by the State of New York, which will be converted into a mere waste of public moneys if the flow of water over these falls is to be seriously diminished.

While this is, of course, a very serious consideration, I have not permitted myself to lose sight of the importance to the industries dependent upon the maintenance of the canal for their power, which action on the part of the State authorities will have.

It is a very grave duty to be compelled to pass upon public questions wherein such great private interests are concerned. Nevertheless it is one which I see no way to escape, and while from certain considerations I would be pleased to arrive at a different conclusion, I am compelled to hold, from my examination of the law on the subject, that the Niagara Falls Hydraulic Power and Manufacturing Company may be restrained from increasing the capacity of the canal. It is only fair, however, that my reasons for this conclusion should be stated. They are as follows:—

The Niagara river is a public navigable stream, to the bed of which, and the water flowing over it, the state and not the riparian owner has title.

It would be a waste of time to attempt to show why this proposition is correct. It is sufficient to say that it has been amply supported by judicial decisions and is now the established law.

Ill. C.R.R. Co. *v.* Ill. (146 U.S., 387).

Smith *v.* Rochester (92 N.Y., 479).

Matter of St. Reservation (16 Abb. N.C., 395).

The sole question, therefore, for determination is, 'Can an owner of the soil adjoining a navigable stream divert the water for private manufacturing purposes without the consent of the State?' Let us examine it.

By the term 'navigable,' it must be remembered, is not meant 'capable of being navigated.' As used in this discussion, 'navigable stream' means one which is navigable in the legal sense. Rivers may be navigable in fact but not in law, or they may be navigable in law but only in part navigable in fact. A mere local interruption of actual navigability, therefore, will not change the character of a stream in its legal aspect.

The river being navigable, in the legal sense, the title to the bed of the stream and to the water flowing over it is in the state, at least to the boundary line between the state and Canada.

People *v.* Appraisers (33 N.Y., 464).

Crill *v.* Rome (47 How. Pr., 398).

Morgan *v.* King (35 N.Y., 454).

People *v.* Tibbetts (19 N.Y., 523).

Ex parte Jennings (6 Cow., 518).

Therefore, leaving out of view for the present the grant of land under water to the Hydraulic Power and Manufacturing Company, the state could unquestionably deprive the corporation of all use of the waters of the river for power purposes by devoting the stream to other public use.

Smith *v.* Rochester (92 N.Y.).

Whether or not that has been done by the laws establishing the Niagara reservation I will discuss hereafter. I prefer at this point to consider the abstract question of the right of an owner of land adjoining a navigable stream to divert a considerable portion of the waters for manufacturing purposes without a grant or prescriptive right.

Nuisances may always be abated by action in the name of the aggrieved party. Public nuisances include any encroachment upon highways or navigable streams, and it is not an essential characteristic of the encroachment upon the stream that it should be an actual hindrance to navigation.

Wood on Nuisances, 2d ed., sees. 478-480, and cases cited.

The diversion of water from a public stream for any other than domestic purposes is a nuisance, and therefore may be abated at the suit of the Attorney-General

Philadelphia *v.* Gelmartin (71 Penn. St., 140).

The Niagara Falls Hydraulic Power and Manufacturing Company is organized under the Act of 1875, chapter 611. Its objects are declared to be the development of the hydraulic canal in Niagara Falls, and the establishment and conducting of various manufacturing interests. Under its charter it is not only supplying its own mills but is furnishing other industries with power for a consideration. So far as the latter fact is concerned, certainly no question can be raised as to the rights of a riparian owner to the use of water for his own benefit. I assume the fact that the capacity of the canal at the outset was sufficient for all the purposes of the power company, and that the increased capacity is desired for the purpose of enabling the corporation to derive a revenue from its sale of power to others. I have no hesitation in declaring this to be unlawful. A non-riparian owner is not entitled to any benefits of a stream other than those enjoyed in common by the public, and a riparian owner at the most is entitled only to

personal benefits derivable from use devoted to personal purposes solely They do not include the transmission of power to property located upon premises that may be far removed from the lands of the riparian owner.

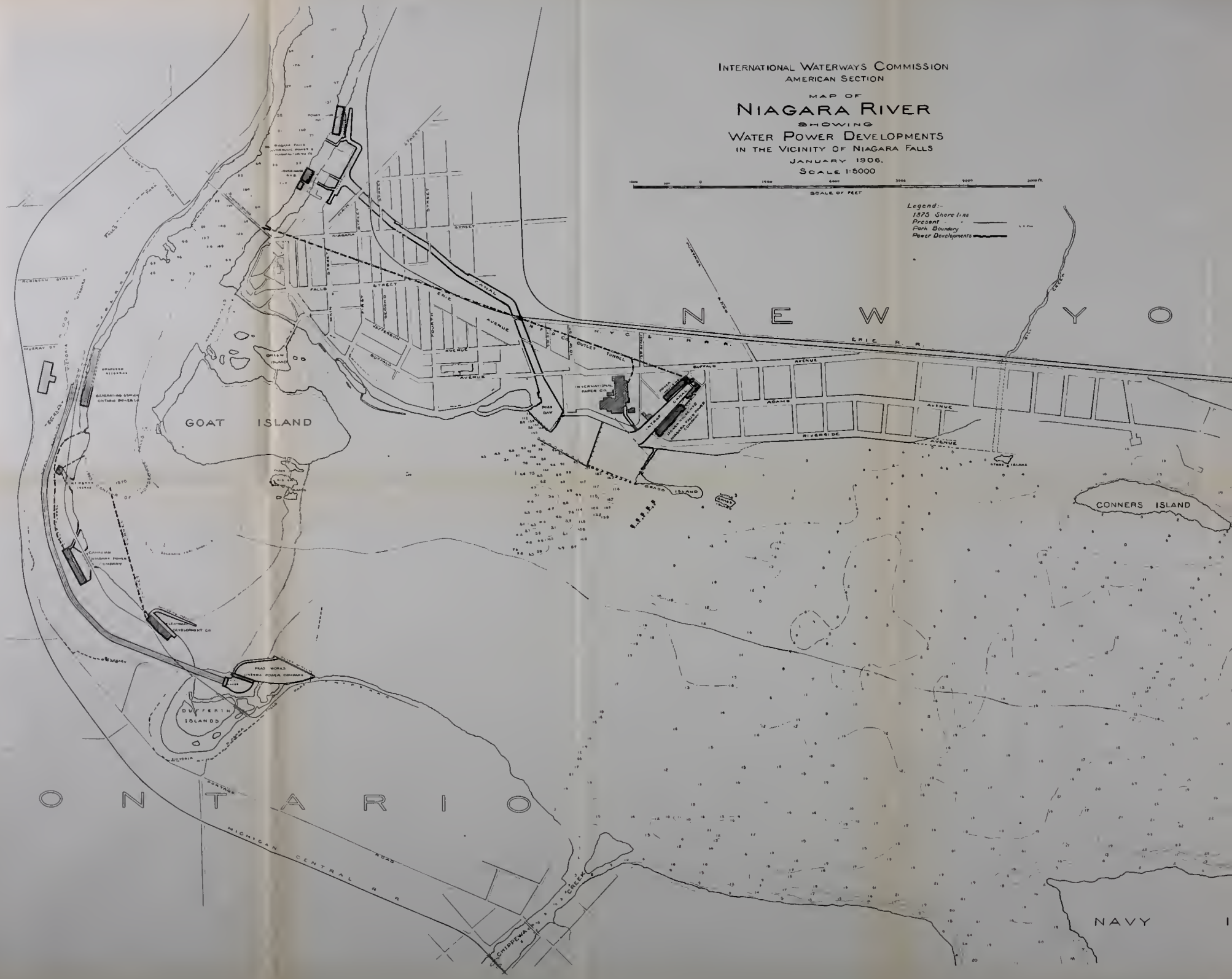
The case last cited was an action brought by the owner of a boat which had been prevented from navigation the Schuylkill, by reason of the diversion of the waters of that stream by the city of Philadelphia for domestic or other purposes. The court in its opinion says:

'In deciding upon the question of illegality in drawing off the water from the navigation, we are carried beyond its use for power, to enquire into the character of the consumption claimed as an overruling necessity. We have already seen that the city is a large vendor of water from which she is deriving revenue, for all the purposes of the arts, manufacturing, business and pleasure. These uses are not domestic, that is, such as are for the preservation of the life and health of the population and their creatures, but are simply utilitarian or business uses, and far exceed those needed for domestic purposes. And even as to those termed domestic, a distinction must be noted between the use proper and that which is lavishly expended in pavement washing, baths, &c. It is perfectly obvious, therefore, that the city drew off water not only for driving and lifting power, but for a consumption far beyond any imperious necessity, and for purposes wholly subordinate to the right of navigation. She chose to prefer the pecuniary interests of her citizens, and doing an injury thereby she must make compensation to the injured parties. I mean not by these remarks to draw any comparison between the importance of the use of the water for the great purposes of industry, wealth, and cleanliness of a city so populous as Philadelphia, and the use of it for navigation during a few days of drought. The question for us is that of legal right, not comparative might. Such important interests as those of the city are not likely to lead to the substitution of might for right; yet, they are not of that imperious necessity which justifies might, and changes wrong into right. Administrators of the law, we cannot bend or break the law before a large interest, more than we can before one that is small. The doctrine of imperious necessity is not in this case.'

It is historical that the Niagara river at Fort Day has been navigated by vessels of large burden, and, indeed, to a point some distance below. The erection of cribs to divert ice and other refuse from the canal inlet is, therefore, an actual obstruction to navigation, and it is not necessary to show present use of the river at this point for navigation purposes. Once a highway, always a highway, is true of navigable streams. (See Yolo *v.* Sacramento, 38 Cal., 193; Wood on Nuisances, 478, 485.)

Ex parte Jenkins (6 Cowen, 518) is also of interest on this point. That was a proceeding brought in mandamus to compel commissioners appointed to appraise damages occasioned by the diversion of the stream of the Chittenango for the purposes of the Erie Canal, which diversion prevented the use of the water of the stream by riparian owners for power purposes in operating mills. The court in awarding mandamus, says:—

'The objection is contained in the affidavits of Mr. Seymour that, in point of fact, the State has not parted with the land upon which the Chittenango passes, at the places claimed, but had bounded purchases of land on the margin of the stream, so that, as he believes (and he believes the other appraisers were satisfied of the fact being so), the State was still the owner of the land covered by the waters of the stream, and had not parted with it or contracted to part with it, to any person whatever, or authorized the use of the water for hydraulic purposes at the places in question. If the construction set up by the commissioners be the true one, if the State owns the land covered by the water, it is clear that, though the relators may be entitled to the use of the water flowing by and touching upon them for all ordinary purposes, yet they cannot build mills upon and raise the water of the stream. They are trespassers, and the State


INTERNATIONAL WATERWAYS COMMISSION
AMERICAN SECTION
MAP OF
NIAGARA RIVER
SHOWING
WATER POWER DEVELOPMENTS
IN THE VICINITY OF NIAGARA FALLS
JANUARY 1906.
SCALE 1:5000
SCALE OF FEET
Legend:-
1875 Shoreline
Present
Park Boundary
Power Developments
N E W Y O
ONTARIO
GOAT ISLAND
GRASS ISLAND
CONNERS ISLAND
NAVY
ERIE R. R.
N.Y.C. & H.R.R.
MICHIGAN CENTRAL R.R.
CHIPPEWA
CREEK
FALLS STREET
NIAGARA STREET
BUFFALO AVENUE
ADAMS AVENUE
RIVERSIDE AVENUE
ERIE CANAL
OUTLET TUNNEL
INTAKE
DUFFERIN ISLANDS
PORTAGE ROAD

INTERNATIONAL WATERWAYS COMMISSION
AMERICAN SECTION
MAP OF
NIAGARA RIVER
SHOWING
WATER POWER DEVELOPMENTS
IN THE VICINITY OF NIAGARA FALLS
JANUARY 1906
SCALE 1:8000
SCALE OF FEET
Legend
1873 Shore line
Present
Park Boundary
Power Developments
N
N E W Y O R K
ERIE R R
CONNERS ISLAND
BUCKHORN
ISLAND
NAVY ISLAND
GRAND
ISLAND

may claim not only the waters, but the mills themselves, so far as they encroach upon the stream.'

I will not consider the effect of the grant by the land commissioners of lands under water to the corporation operating the canal.

The powers of the land commissioners at the time the grant was made were conferred by section 67, page 633, volume 1, eighth edition, Revised Statutes. It reads:

'The commissioners of the land office shall have power to grant, in perpetuity or otherwise, so much of the lands under the waters of navigable rivers or lakes as they shall deem necessary to promote the commerce of this State, or proper for the purpose of beneficial enjoyment of the same by the adjacent owner.'

The court of appeals, in passing upon the character of such grant, says: 'In every such grant there was an implied reservation of the public right to impede or obstruct navigation, or to make an exclusive appropriation of the use of navigable waters, the grant was void.'

Again: 'Public grants to individuals under which rights are claimed in impairment of public interests, are construed strictly against the grantee, for it is reasonable to suppose that if they were intended to have this operation, the intention would have been expressed in plain and explicit language.'

People *v.* N.Y. & Staten Ferry Island Co. (68 N.Y., 71).

I have been unable to find any language in the grant to the Niagara Falls Hydraulic Power and Manufacturing Company which can be construed as authorizing them to divert the waters of the Niagara river. Applying the principles in the case last cited, it is certain that that grant can afford no defence to an action brought to restrain the unlawful taking of the waters.

It now remains to determine whether or not the waters of the Niagara river have been devoted by the legislature to a public use to an extent that will prevent the diversion of the water above the falls for power purposes. The objects and purposes of the statutes creating the Niagara reservation were to preserve a great natural waterfall and its environments for the enjoyment of the people of this State. In fact, the statutes themselves declare that the commissioners shall take all proper steps to restore and afterwards to preserve the scenery as nearly in its natural state as possible.

The flow of water over the falls is an essential element in the preservation of the scenery, and if it can be shown (as I am informed it can) to be the fact that the diversion of the large quantities of water through the canal of the Niagara Falls Hydraulic Power and Manufacturing Company has a diminishing effect upon the flow of the water over the falls, the diversion is a nuisance and can be restrained.

All of which is respectfully submitted.

T. E. HANCOCK,
Attorney-General.

HON. ANDREW H. GREEN,
President Niagara Reservation Commission, New York city.

APPENDIX B.

LIST OF DEPENDENT INDUSTRIES OF THE NIAGARA FALLS HYDRAULIC POWER AND MANUFACTURING COMPANY.

Electric light for street and store service
Pittsburg Reduction Company.
Niagara Falls Brewing Company.
Wm. A. Rogers (Limited.)
Cliff Paper Company.
Cataract City Milling Company.
Pettebone-Cataract Paper Co.
Oneida Community Company.

Niagara Gorge Railroad.
Youngstown and Lewiston Railroad.
National Electrolytic Company.
Acker Process Company.
Walker Manufacturing Company.
City Waterworks.
Niagara Falls Milling Company.
Carter Crum Company.
Central Machine Company.

APPENDIX C.

The Niagara Falls Power Company—List of users.

	Maximum power.	Transmission distance.
NIAGARA FALLS, N.Y.	*Horse-power*	*Miles.*
The Pittsburg Reduction Co	8,000	0·46
The Carborundum Co	5,000	·38
Union Carbide Co	17,000	2·00
Niagara-Electro Chemical Co	3,000	·75
Niagara Falls Lighting Co	1,000	·14
International Railway Co	1,500	.....
The Niagara Falls Water Works Co. (hydraulic power)	300	.....
International Paper Co. (hydraulic power)	8,000	.....
Castner Electrolytic Alkali Co	8,500	·85
Oldbury Electro-Chemical Co	2,500	2·18
International Acheson Graphite Co	2,000	·28
Acetyvone Manufacturing Co	50	·95
Roberts Chemical Co	500	1·90
Francis Hook and Eye Fastener Co	15	·47
Norton Emery Wheel Co	1,500	·95
The Natural Food Co	1,500	·66
Ramapo Iron Works	500	1·70
By-Products Paper Co	500	·19
Composite Board Co	200	·34
Niagara Research Laboratories	500	·28
Lockport Paper Co	500	.....
Cataract Consumers Brewery	140	.....
Development and Funding Co	750	.....
Niagara Tachometer and Instrument Co	15	.....
Ozone Vanillin Co	125	.....
Phosphorus Compounds Co	50	.....
Acheson Siloxicon Articles Co	50	.....
Niagara River Manufacturing Co	800	.....
NIAGARA FALLS, ONTARIO.		
A. C. Douglas, contractor	400	3·00
Niagara, St. Catharines and Toronto Railway	500	3·80
Lighting Co	500	3·40
Canadian Shredded Wheat Co. (Limited)	75	.....
International Acheson Graphite Co	200	.....
Larkin, Sangster and Marshall, contractors	2	.....
Loretto Convent	40	.....
Monastery of Mount Carmel	35	.....
TONAWANDA.		
International Railway Co	1,500	.....
Tonawanda Board and Paper Co	1,200	15·00
Buffalo Bolt Co	160	14·00
Philip Houck Milling Co	142	14·00
F. J. Alliger Co	107	15·00
Adamite Abrasive Co	50	14·50
Orient Manufacturing Co	20	14·00
Felton School	22	14·00
LOCKPORT.		
nternational Railway Co	1,000	26·00

The Niagara Falls Power Company—List of users—Continued.

	Maximum power.	Transmission distance.
OLCOTT.	*Horse-power*	*Miles.*
International Railway Co.	1,000	39·00
BUFFALO.		
Buffalo General Electric Co.	6,000	27·60
Great Northern Elevator	900	29·50
Electric Grain Elevator	200	30·70
Buffalo Elevating Co.	950	29·00
Buffalo Cereal Co.	375	30·30
American Brake Shoe and Foundry Co.	40	33·20
Charles G. Curtiss Co.	125	25·50
McKinnon Dash Co.	100	24·40
The Gypsum Products Co.	.....	.....
The General Railway Signal Co.	.....	.....
Schoellkopf & Co.	50	30·00
The National Battery Co.	90	26·30
International Railway Co.	.....	.....
Great Eastern Elevator	900	30·00
Buffalo Dry Dock Co.	133	30 00
Edward Elsworth & Co. (H. O. Mills)	150	30·00
Snow Steam Pump Works	150	33·30
The Jacob Dold Packing Co.	100	32·50
The John Kam Malting Co.	225	24·30
Pratt & Letchworth Co.	.....	.....
The Wood & Brooks Co.	100	24·40
Sidney Shepard & Co.	100	30·00
Iron Elevator and Transfer Co.	165	30·00
W. W. Oliver Manufacturing Co.	15	24·70
New York Car Wheel Co.	200	24·30
The United States Rubber Reclaiming Works	995	31·70
The American Radiator Co. (Bond plant)	200	24·00
Barcalo Manufacturing Co.	.....	.....
American Agricultural Chemical Co.	125	32·00
Acme Steel and Malleable Iron Works	50	24·80
CumpsonPrentiss Coffee Co.	30	29·10
J. I. Prentiss & Co.	30	29·00
Schoellkopf, Hartford & Hanna Co.	.....	.....
The U. S. Hame Co.	.....	.....
Knowlton Warehouse Co.	.....	.....
Iroquois Brewing Co.	.....	.....
Faxon, Williams & Faxon (bakery)	.....	.....
The Sherwood Manufacturing Co.	.....	.....
Duffy Silk Co.	.....	.....
America School Furniture Co.:		
Foundry	.....	.....
Works	.....	.....
Buffalo City Waterworks	.....	.....
Duluth Souperior Milling Co.	.....	.....
The Frontier Ice and Stone Co.	.....	.....
The New York Central and Hudson River R.R. (shops)	.....	.....
The Erie R.R. Co. (shops)	.....	.....
The General Chemical Co.	.....	.....
The Oswegatchie Manufacturing Co.	.....	.....
G. F. Zeller & Sons	.....	.....
Buffalo Foundry Co.	240	35·10
H. O. Mills Annex	255	29·30
The Jewett Refrigerator Co.	30	24·8.
Buffalo Pitts Co.:		
Works	187	25·50
Foundry	.....	.....
Buffalo Brake Beam Co.	30	35·00
Buffalo Dental Manufacturing Co.	20	35·50
Keystone Manufacturing Co.	2[illegible]	24·80
R. L. Ginsburg & Sons	33	34·00
Buffalo Weaving and Belting Co.	65	25·50
H. W. Dopp Co.	10	25·00
Frontier Iron Works	15	25·00

The Niagara Falls Power Company. List of users. Concluded.

BUFFALO—Concluded.	Maximum power. *Horse-power.*	Transmission distance. *Miles.*
The Crosby Co	50	33·00
Spencer Kellogg	500	29·20
The Lake Erie Engineering Works		
John Schmitz		
The Battle Creek Breakfast Food Co.		
The Collins Baking Co	50	33·20
George Urban Milling Co	450	34·50
C. Kurtzmann & Co		
The Buffalo Gasoline Motor Co.	20	25·00
The Niagara Mill and Elevator Co	100	26·00
Pratt & Lambert	10	24·50
The Delaware, Lackawanna and Western R. R. shops	150	34·50
The Niagara Cordage Co		
The U.S. Headlight Co.	40	26·00
H. Messersmith (Laverack Building)	100	28·20
The Buffalo Structural Steel Co	30	26·00
The Wegner Machine Co	40	29·00
J. N. Adam & Co	100	28·20
The estate of Walter Cary (Genesee Hotel	100	28·10
The McLean Box Factory		
The George N. Pierce Co.		
The American Malting Co		
The Buffalo Fertilizer Co.		
The Buffalo Rubber Manufacturing Co.		
The U. S. Cast Iron Pipe and Foundry Co		
The L. V. R. R. Co. shops		
The Buffalo Box Factory		
American Radiator Co. (Pierce plant)		
Rogers Plating and Foundry Co.		
Fleming Warehouse Co.		
Hewitt Rubber Co.		
C. & B. Transit Co.		
The D. H. Stoll Co.		
The Ontario Elevator		
L. M. Eriesson Telephone Manufacturing Co		
The Niagara Malting Co		
The Buffalo Union Furnace Co		

APPENDIX D.

Statement concerning companies incorporated to take water from Lake Erie and Niagara river, but which have not as yet constructed works under these charters.

AMERICAN SIDE.

Lockport Water Supply Company. Incorporated 1886. New York State. Empowered to supply water for manufacturing and other purposes to cities within the county of Niagara; to take water from the Niagara river between the mouth of Tonawanda creek and the east line of lot No. 52 of the Mile reserve, and to discharge water into Lake Ontario or into Eighteen Mile creek. Work to be commenced by 1891. No work done.

Lewiston Water Supply Company. Incorporated 1888. New York State. Empowered to supply water to Lewiston and other towns in the township of Niagara and Lewiston for manufacturing or other purposes; to take water from the Niagara river between Cayuga creek and the east line of lot 46, Mile Reserve; discharge water into Niagara river near the town of Lewiston. Work to be commenced by 1893. No work done.

Buffalo and Niagara Power and Drainage Company—Incorporated 1889. New York State. Empowered to build and operate public raceway in connection with the Niagara river for water power and other purposes; to take water from and discharge water into the Niagara river at such points as may be convenient. Work to be completed by 1894. No work done.

Niagara County Irrigation and Water Supply Company.—Incorporated 1891. New York State. Empowered to build and operate public waterway from Niagara river between Cayuga creek and lot 71 of Mile Reserve; to supply water to Lewiston and other villages in the townships of Niagara, Lewiston and Porter; to lease and sell water for manufacturing and other purposes; to take water from Niagara river between points specified and discharge into Niagara river near Lewiston or Porter. Work to be commenced by 1896. This company claims to have done some work, and to be proceeding with development.

Niagara Power and Development Company, originally the Model Town Company.—Incorporated 1893. New York State. Further legislation 1894. Authorized to build a town and equip plants for all public utilities therein. Empowered to take water from Lake Erie or Niagara river for all purposes except for motive power for factories. May purchase or lease franchise of the Niagara County Irrigation and Water Supply Company.

Niagara, Lockport and Ontario Power Company.—Incorporated 1894. Empowered to supply water and electricity to Lockport and other cities in Niagara, Erie, and Orleans counties; to take water from the Niagara river between mouth of Tonawanda creek and east line of lot 52 of Mile Reserve and discharge water into Lake Ontario or Eighteen Mile creek. Work to be commenced by 1904. In 1904 failed to obtain legislation to perpetuate right to take water from Niagara river. Is now building works for distribution of electric energy.

APPENDIX E.

Statement concerning companies incorporated to take water from Lake Erie and Niagara river, which have not as yet constructed works under these charters.

CANADIAN SIDE.

Ontario Power Company, originally Canadian Power Company.—Incorporated 1887. Dominion Parliament. Other legislation 1891, 1893, and 1899. Empowered to build a canal and hydraulic tunnel from Welland river, near junction of Niagara, to Niagara river south of the whirlpool, and to supply water, electricity, or other power. As this company is empowered to make two separate developments, one of which is well under way, and as the Act of 1899 empowers it to extend and enlarge its works as demanded by business, there is apparently no limit as to the time when the second development may be commenced.

Hamilton Cararact Power, Light and Traction Company, originally Cataract Power Company of Hamilton.—Incorporated 1889. Province of Ontario. Further legislation 1904. Empowered to build and operate a canal and raceway from near Allanburg to the Welland river near Port Robinson as an extension of their canal from near Deeews Falls. This company is said to lease from the Dominion government water from the Lake Erie level of the Welland canal.

Jordan Light, Heat and Power Company, originally Hamilton and Lake Erie Power Company.—Incorporated 1895. Further legislation 1898, 1903. Dominion parliament. Empowered to build and operate water course from Welland river between 12 and 30 miles from Niagara river to a point on Jordan river, and may dredge Welland and Jordan rivers; to use the waters of Lake Erie and Niagara river in such quantity as may be necessary for their purposes; to supply water and electricity or other power. To be completed by 1911.

Erie and Ontario Power Company.—Incorporated 1903. Dominion Parliament. Authorized to build and operate water course from Grand river Lake Erie to Jordan River and Lake Ontario; to take waters of Lake Erie and to dredge Jordan river; to supply electric or other power and convey the same. To be completed 1908.

Niagara Welland Power Company, originally Welland Power and Supply Company.—Incorporated 1894. Further legislation 1891, 1899, 1903, and 1905. Dominion Parliament. Empowered to build and operate canal from Welland river near Niagara river to near Thorold and to carry off surplus water to Lake Ontario; to supply power and to use canal for navigation. To be completed by 1910.

North American Canal Company.—Incorporated 1893. Dominion Parliament. Authorized to build and operate canal from Lake Erie near Port Colborne to Lake Ontario near Port Dalhousie, or to Niagara river near Queenston; canal to be 20 feet deep and sufficient width for two of the largest vessels to pass at full speed. Authorized to maintain a current of 3 miles per hour. To sell or lease water and hydraulic or other power. May dredge in the Welland and Niagara rivers. To be completed by 1903.

DEPARTMENT OF STATE,

WASHINGTON, March 19, 1906.

THE PRESIDENT:

In reply to your letter of the 15th instant, transmitting the resolution of the Colonial Dames of America relative to the preservation of Niagara Falls, and stating your desire to be informed regarding the present status of the negotiations with Great Britain on the subject, I have the honour to inclose herewith copies of correspondence had to the present time, through the War Department, with the American section of the International Waterways Commission.

Respectfully submitted,

ELIHU ROOT.

DEPARTMENT OF STATE,

WASHINGTON, February 13, 1906.

SIR,—Several months ago the State Department and the British ambassador took up the subject of a possible treaty between the United States and Great Britain relating to the use of the waters of the Niagara river and the preservation of the falls.

On the 13th of November the ambassador transmitted to the department, a report of the Canadian Privy Council, approved November 2, 1905, which stated that a report from the Canadian section of the Waterways Commission stated that the commission was studying the subject and expected to be able to 'make a joint report to the government of the United States and to the govern-

ment of Canada before long, recommending the adoption of rules and regulations which would prevent in the future the destruction of Niagara Falls by the use of its waters by manufacturers.'

In the report by the American section, made to the Secretary of War on December 1, 1905, occurs the following statement:—

'The commission has made good progress in the collection of data bearing upon some of these questions, particularly those relating to the use of water at Niagara Falls.'

On the 28th of October, 1905, the commission appears to have adopted the following resolutions:—

Resolved, That this commission recommends to the governments of the United States and Canada that such steps as they may regard as necessary be taken to prevent any corporate rights or franchises being granted or renewed by either Federal, State, or provincial authority for the use of the waters of the Niagara river for power or other purposes until this commission is able to collect the information necessary to enable it to report fully upon the 'conditions and uses of those waters to the respective governments of the United States and Canada.

The negotiation relating to a treaty on this subject has been suspended awaiting the further report of the commission, in accordance with the statements to which I have referred. There are many indications of active public interest in this subject, and a joint resolution having in view the preservation of the falls, pending in the House of Representatives, has been favourably reported by the committee on Rivers and Harbours. The indications are that if an agreement can be reached between the two countries as to the action necessary to accomplish the purpose, any legislation to give the agreement effect on the part of the American authorities would receive favourable consideration at the present session of congress and at the present session of the New York legislature.

It seems desirable, therefore, to press forward the negotiations for such an agreement without any avoidable delay. May I ask you to ascertain whether the joint commission is not now prepared to make such a report upon the subject as may furnish a basis upon which the State Department and the ambassador may take up and proceed with the negotiation?

I have the honour to be, sir, your obedient servant,

ELIHU ROOT,

The Secretary of War.

War Department,

Washington, February 19, 1906.

Sir,—I have the honour to acknowledge the receipt of your letter of the 13th instant, in which you call attention to the fact that negotiations for a possible treaty between Great Britain and the United States in regard to the use of waters of Niagara river and preservation of the falls are now suspended, awaiting a further report from the International Waterways Commission, and you ask me to ascertain whether the joint commission is now prepared to make such report as may furnish a basis upon which the Department of State and the British ambassador may be able to proceed with the matter.

Replying thereto I beg to inform you that the chairman of the American section of the International Waterways Commission, Col. O. H. Ernst, to whom your letter was referred, reports under date of 17th instant, as follows:—

A copy of this letter has been sent to the chairman of the Canadian section to discuss and act upon the question referred to at their next meeting.

It is expected that a meeting can be held during the week beginning February 26, when it is hoped and believed that the map of the locality which the commission has had under construction will be entirely completed.

The outcome of the meeting referred to by Colonel Ernst will be promptly communicated to the Department of State.

Very respectfully,

ROBERT SHAW OLIVER,

Acting Secretary of War.

The SECRETARY OF STATE.

DEPARTMENT OF STATE,

WASHINGTON, March 13, 1906.

MY DEAR MR. SECRETARY,—I notice in the newspapers that the International Waterways Commission has taken some action about the Niagara Falls matter.

Have you received any report? If not, can you get one from them?

Very truly yours,

ELIHU ROOT.

HON. WILLIAM H. TAFT,

Secretary of War.

REPORTS ON THE EXISTING WATER-POWER SITUATION AT NIAGARA FALLS, SO FAR AS CONCERNS THE CANADIAN POWER COMPANIES AND THEIR ASSOCIATED TRANSMISSION COMPANIES.

REPORT BY THE AMERICAN MEMBERS OF THE INTERNATIONAL WATERWAYS COMMISSION.

OFFICE OF AMERICAN SECTION,

BUFFALO, N.Y., September 29, 1906.

MR. SECRETARY,—The American members of the International Waterways Commission have examined the report dated August 15, 1906, by Capt. Charles W. Kutz, Corps of Engineers, U.S. Army, upon the subject of permits to the power companies at Niagara Falls, referred to them by your endorsement of September 5. They have the honour to return it herewith, and to submit in connection therewith the following remarks:—

SESSIONAL PAPER No. 19a

In our report* dated March 19, 1906, we stated that the works projected on the American side at Niagara Falls would produce 342,000 horse-power besides a small amount on the Erie canal, and would consume about 28,000 cubic feet of water per second, while those projected on the Canadian side would produce 432,000 horse-power besides a small amount on the Welland canal, and would consume about 36,000 cubic feet of water per second. We thought that the amount on the American side could be reduced to 242,000 horse-power, using 18,500 cubic feet of water per second, without inflicting undue hardship upon invested capital, but we doubted the expediency of attempting to withdraw the other rights acquired by the power companies at Niagara Falls. These views were adopted by Congress with qualifications.

In the Act approved June 29, 1906, the amount of water to be diverted on the American side was cut down to 15,600 cubic feet per second in the first instance, but with the provision that additional amounts may be diverted after an interval of not less than six months if it be found that that can be done without detriment to Niagara Falls or the river.

The amount of power to be generated on the Canadian side was cut down from 423,000 to 350,000 horse-power, the control of Congress in the matter arising from the fact that a very large percentage of the Canadian output must under present conditions, find a market in the United States. Under no circumstances is the total to be increased, but the amount which may be transmitted to the United States is to be diminished as the amount consumed in Canada shall increase. In this sliding scale a limit is fixed which divides the permits into two kinds, one of which may possibly be expected to have somewhat more permanency than the other, viz., *permits* to transmit electrical power from Canada into the United States to the aggregate amount of 160,000 horse-power, and *revocable permits* for the transmission of additional electrical power to the extent just indicated. It appears to us that this distinction was made for the purpose of giving a little more assurance of permanency to certain of the permits than it was possible to give to all of them, and not for the purpose of trying an experiment as to the effect upon the falls, of the diversion of a quantity of water so indefinite in amount. This view seems confirmed by the fact that the maximum amount allowed on the Canadian side, 350,000 horse-power, is about 83 per cent. of the amount mentioned in the report, 423,000 horse-power, while the amount allowed on the American side, 15,600 cubic feet per second, is about 84 per cent. of that mentioned in the report, the percentage of reduction thus being practically the same in the two cases. We see no reason why revocable permits for the transmission of power from Canada into the United States, additional to the 160,000 horse-power first to be authorized, should not be issued without delay if application for such permits be received.

The law provides for the issuance by the Secretary of War of four kinds of permits, viz.:—

1. Permits to divert water from the Niagara river on the American side to an aggregate amount not exceeding 15,600 cubic feet per second.

2. Revocable permits to divert additional water fom the Niagara river on the American side to such amount, if any, as shall not injure the river as a navigable stream or a boundary stream, and shall not injure the scenic grandeur of Niagara Falls; but no such permits shall be issued until approximately the 15,600 cubic feet per second mentioned above shall have been diverted for a period of not less than six months.

3. Permits to transmit electrical power from Canada into the United States to the aggregate amount of 160,000 horse-power.

4. Revocable permits for the transmission of additional electrical power from Canada into the United States, but in no case shall the amount included in

*Printed in Senate Doc. No. 242, Fifty-ninth Congress, first session.

such permits together with the 160,000 horse-power mentioned above and the amount generated and used in Canada exceed 350,000 horse-power.

Applications have been received for permits of the first and third kinds, but in this report Captain Kutz confines himself to a consideration of those relating to the transmission of power from Canada into the United States, deferring to a future report all that concerns the diversion of water on the American side. He defers also a consideration of the question of granting transmission permits for amounts additional to the first 160,000 horse-power, expressing the opinion that it is 'the intent of the law to delay the issue of such permits until it is known what appreciable effect, if any, will be produced on the falls by the diversion of the amount of water that will be used under the first limitation.' As above stated, we do not concur in that opinion; but the fact that no applications have been received for permits of this kind is sufficient reason for not discussing them at this time.

Applications for the transmission of power have been received from four companies, including the International Railway Company, whose rights under Canadian law to transmit power to the United States are in dispute and whose claims are small compared with those of the other companies. Captain Kutz recommends that no permit be issued to that company at this time, but that 2,500 horse-power be reserved for the present in order that it may be possible to grant the company a permit for that amount hereafter should the controversy over its rights under the Canadian laws be decided in its favour. In that recommendation we concur.

There will remain 157,000 horse-power to be divided among the three remaining applicants. These applicants are the American transmission companies, but their interests are identical with those of the Canadian companies from who they derive power and must be considered in connection therewith. They are:

1. Niagara, Lockport and Ontario Company, taking power from the Ontario Power Company, applying for 90,000 horse-power.

2. Electrical Transmission Company, taking power from the Electrical Development Company, applying for 62,500 horse-power.

3. Niagara Falls Power Company, taking power from the Canadian Niagara Power Company, applying for 121,500 horse-power.

The application of the Niagara Falls Power Company is for 11,500 horse-power more than the capacity of the works from which it is to derive power when completed as designed. The other companies ask for one-half the capacity of the works furnishing the power when completed as designed. The total amount asked for is 274,000 horse-power.

Captain Kutz has spared no pains in the collection of all the facts which have a bearing upon the question of how the available amount shall be divided among the three companies. After a careful consideration of the amounts of capital invested in the power plants, the amounts required to complete the works as designed, their capacity as completed under expenditures now made or pledged, their capacity as designed, the amounts of capital invested in transmission lines in the United States or on Canadian soil to connect with the United States, the contracts made for furnishing and receiving power, and other data, he concludes that there is no sufficient reason for discrimination between the companies except their relative ability to command the Canadian market. The Electrical Development Company was organized with that market prominently in view and is able to obtain a sale there of about 25,000 horse-power more than either of the other companies. Its claim to the American market is diminished by that amount. If the quantity allotted to that company be 37,500 horse-power there will remain 120,000 horse-power to be equally divided between the Ontario Power Company and the Canadian Niagara Power Company, giving them 60,000 horse-power each. We believe this to be an equitable division of the power available and we

join with Captain Kutz in the recommendation that permits for the transmission of power to the United States be granted to:

	Horse-power.
The Niagara, Lockport and Ontario Company from the Ontario Power Company	60,000
The Electrical Transmission Company from the Electrical Development Company	37,500
The Niagara Falls Power Company from the Canadian Niagara Power Company	60,000

Yours very respectfully,

O. H. ERNST,
Chairman.

GEORGE CLINTON,
Member.

E. E. HASKELL,
Member.

Hon. W. H. TAFT,
Secretary of War.

REPORT BY CAPT. CHARLES W. KUTZ, CORPS OF ENGINEERS UPON THE WATER POWER SITUATION ON THE CANADIAN SIDE OF NIAGARA FALLS.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
WASHINGTON, August 15, 1906.

GENERAL,—1. In compliance with the written orders of the Secretary of War, dated July 14, 1906 (copy attached marked A), and your subsequent oral instructions, I have the honour to submit herewith the following report upon the existing power situation at Niagara Falls:—

2. The information called for by the Secretary of War concerns not only the power companies now diverting water on the American side, but also those on the Canadian side who are seeking through their associated transmission companies to import power into the United States. This latter information, being of more immediate importance, will be considered first.

3. The four Canadian companies applying directly or through their transmission companies for permits to import power are the Ontario Power Company of Niagara Falls; the Electrical Development Company of Ontario (Limited); the Canadian Niagara Power Company, and the International Railway Company.

THE ONTARIO POWER COMPANY.

4. This company was incorporated by an Act of the Dominion Parliament in 1887, and is not limited by its statutory rights to the production of any given amount of power. All its plans, however, are subject to the approval of the commissioners for the Queen Victoria Niagara Falls Park. The present approved plans were designed for the production of 180,000 electrical horse-power, using its Niagara river intake. In addition to its Niagara river rights, the Ontario

Power Company has a franchise for taking water from the Welland river, but beyond the purchase of a limited amount of land for right of way for the intake tunnel or canal this franchise has not yet been exercised.

5. The Niagara river plant as designed consists of headworks located above the first line of rapids, three main conduits or flumes 6,000 feet or more in length, leading the water through the park to a point below the falls, thence by penstocks in tunnel through the cliff to the generating station in the gorge, and lastly a distributing station or transformer house situated on the high bluff directly above.

6. The headworks are constructed for the full development; that is, 180,000 electrical horse-power. Only one of the three main conduits has been built, and this has a capacity sufficient, it is claimed, to supply water to 6 generating units, 3 with a capacity of 10,000 electrical horse-power each, and the remaining 3 with a capacity of 12,000 electrical horse-power each. The valve chamber of No. 1 conduit is complete for 7 units except 3 valve motors, and rough excavation has been made for the valve chamber of No. 2 conduit in which an eighth valve has been installed, so that No. 7 can be operated either from No. 1 or No. 2 conduit. Excavation for the power-house is complete for 8 units, the foundation and structure for 6 units. The central or main portion of the transformer house was designed and built for the control of 22 units, the number originally planned for the completed plant. The wings of the transformer house as now built have a capacity for 8 transformer sets, corresponding to 8 generator units. Four transformer sets are now installed. In addition, room is provided in the central part of the building for the passage of 4 additional transmission lines without change of voltage.

7. The books of this company show an expenditure of $5,142,000, exclusive of rentals and rights, with $400,000 due on uncompleted contracts. This total expenditure on power plant of $5,542,000 will complete the installation of 4 units. The installation of 2 additional units, orders for which have recently been given, will require an additional expenditure of $315,000. Of the 4 units now installed, 3 are ready for service, and the fourth lacks only a minor part to make it complete. The order for the fifth and sixth units calls for delivery within twelve months. The estimate furnished by the company of the cost of completing the approved design is $6,500,000.

8. In addition to the expenditure of the Ontario Power Co. itself, there has been expended by the Ontario Transmission Company nearly $1,000,000 in real estate, transmission lines, stations, &c. For financial reasons a separate organization is maintained, but the company is pratically identical with the Ontario Power Company. It owns an interest in the transformer house and owns all the transmission lines in Canadian territory. The Ontario Power Company has Canadian contracts for about 6,000 horse-power, with the option on the part of the purchaser to increase the amount to about 13,000 horse-power. It has a contract with the Niagara, Lockport and Ontario Power Company to deliver at the international boundary for use in the United States 60,000 horse-power, with the option on the part of the purchaser of increasing the amount to 180,000 horse-power. The latter contract is dated July 16, 1904, and provides that the 60,000 horse-power shall be delivered on or before January 1, 1907, with the option on the part of the purchaser of taking 60,000 additional horse-power January 1, 1911, and the third 60,000 horse-power on January 1, 1915.

9. The Niagara, Lockport and Ontario Power Company is building, switching and transforming stations and constructing transmission lines for the purpose of carrying out its contract with the Ontario Power Company. In furtherance of its plans the company has acquired a private right of way containing about 3,200 acres of land, with an unbroken strip 300 feet wide from the Niagara river to Lockport, a distance of 17 miles; thence 200 feet wide to the suburbs of Rochester, a distance of 55 milles; thence 100 feet wide from the suburbs of

Rochester to Fairport, a distance of 12 miles. In addition, a similar private right of way, owned in fee simple 100 feet wide, has been acquired from Lockport southward through the suburbs of Buffalo to the Lackawanna Steel Company's plant, a distance of 27 miles. The company has erected two transmission lines from the international boundary to Lockport, each with a capacity of 30,000 horse-power. From Lockport to Syracuse a single line partly over the right of way of the West Shore railroad has been completed, with a capacity of 10,000 horse-power, and a second line of greater capacity is under construction. On the double line from Lockport to Buffalo work is in progress, 60 per cent of the poles having been erected. Each of the Buffalo lines is to have a capacity of 30,000 horse-power.

10. The books of this company show an expenditure of $2,785,000, of which $1,200,000 is represented by right of way and $1,162,000 is represented by construction. The Niagara, Lockport and Ontario Power Company has actually executed contracts which call for the delivery within the near future of 6,000 horse-power, with provision for fixed increases at intervals varying from three months to three years, so that at the expiration of that time they will have a firm contract with their present customers for 14,240 horse-power, with options on the part of the purchasers which give them the right to increase the amount to 70,000 horse-power. The first of these contracts is dated June, 1905, three others in the fall of 1905, one in March, two in April, and two in May, 1906. In addition the company claims to have contracts verbally closed for 13,000 additional firm horse-power, and negotiations pending for 25,000 firm horse-power, making a total of 52,000 horse-power, for which they hope to have a market in the near future. The optional amounts named in these contracts and negotiations aggregate 166,000 horse-power. At the time of the examination, this company was actually transmitting to the United States 700 horse-power.

THE ELECTRICAL DEVELOPMENT COMPANY.

11. This company was incorporated by Act of the legislature of Ontario (5 Edward VII., ch. 12), for the purpose of developing, distributing and selling electrical power and for other purposes, but its charter gives it no specific right to take water from the Niagara river or its tributaries. To this company was assigned an agreement which three citizens of Canada had entered into with the commissioners for the Queen Victoria Niagara Falls Park, by virtue of which it is authorized to take from the Niagara river, water sufficient to develop 125,000 electrical horse-power. The amount of water for this purpose is computed to be 10,800 cubic feet per second.

12. In pursuance of this agreement, a plant has been designed and partially constructed that will be capable of producing the full amount of power authorized. The headworks are completed except for the removal of the cofferdam, while the wheel-pit and tailrace tunnels are practically completed for the full development. Contract has been entered into for the construction of two-thirds of the power-house structure. The metal work of this part of the building is practically completed and the stone work 50 per cent completed. This will provide cover for 7 of the 11 units that are projected, each of which is designed with a capacity of 12,500 electrical horse-power. Only four generating units have actually been ordered. Two of the four have been delivered at the power-house and are now being installed; one of the two was being made ready for test at the time of the examination, and unless some unforeseen accident occurs should be ready for service during the month of September, and the other three at intervals of six weeks to two months thereafter. The transformer house as constructed is for 5 units. One bank of three transformers is on the ground, a second bank was scheduled for shipment August 1, and the third bank August 15. By its headworks, wheel-pit and tailrace development the company is

committed to the installation of 11 units, by its power house to the installation of 7 units, and by its contracts for machinery to the installation of 4 units.

13. The books of the company show an expenditure to July 1, 1906, on the power plant of $4,500,000. The liabilities, incurred and unpaid, for completing the installation of 4 units are $1,760,000 a total investment in plant of $6,300,000. To complete the installation of 11 units would cost $1,576,000.

14. This company has affiliated with it the Toronto and Niagara Power Company, organized for the purpose of transmitting power from Niagara Falls, Ontario, to Toronto. Its transmission lines, which except for a short section are completed, will have a capacity of 20,000 horse-power, and represent an investment of $1,870,000, with $750,000 required for completion. The demands on this company from Toronto and intermediate territory will probably aggregate between 30,000 and 40,000 horse-power. The Electrical DevelopmentCompany was organized primarily for the purpose of furnishing power to Canadian points, and its arrangements for selling power in the United States are in a more or less embryonic state. For distribution in the United States there was organized the Electrical Transmission Company of Niagara Falls, a corporation chartered under the laws of the state of New York. This company at present is a mere holding company, keeps no books, and all the expenditures made in its name have been advanced by the Electrical Development Company. The books of the Electrical Development Company show an expenditure on this account of $246,000, which was used for the purchase of an interest in the Niagara Falls Gas and Electric Light Company, Niagara Falls Gas Company, and the Albion Power Company, and for the purchase of real estate in Niagara Falls, $40,000 being the amount of the last item. This investment, together with the holdings of the 'Nicholl Syndicate,' a group of men who control the Electrical Development Company, gives control of these subsidiary companies to the power company.

15. The value of the properties thus controlled is approximately $1,000,000. The Niagara Falls Electrical Transmission Company also has an agreement with the International Railway Company looking to the building of a bridge crossing the Niagara river to be owned jointly by the two companies, across which it is proposed to convey power that is sold by the Electrical Development Company to the Niagara Falls Electrical Transmission Company. Negotiations with this company (I. R. R. Co.) also contemplate the granting to the transmission company of a right of way for its transmission lines over the right of way now being acquired by the railway company between Niagara Falls and Buffalo. This agreement with the International Railway has not yet assumed the form of a written contract. For carrying its transmission lines to Rochester this company proposes to use the right of way of the Buffalo, Lockport and Rochester Electric Railway. There is no contract to this effect but as the Buffalo, Lockport and Rochester Railway is controlled by the Nicholl Syndicate above referred to, there is a community of interest. The Buffalo, Lockport and Rochester Railway is now under construction, the contract for grading a double-track road and for the construction of a single-track road having been entered into with J. G. White & Company, contractors, on May 14, 1906, at a cost of $2,250,000. In addition to the above the Electrical Transmission Company has acquired franchises in its own name in seven cities and towns in western New York for the sale and transmission of power, and through the Niagara Falls Gas and Electric Light Company and the Albion Power Company it controls twenty other such franchises. The Niagara Falls Electrical Transmission Company has not executed any contracts for the delivery of power, but expects that its allied interests will require 17,500 horse-power. This expectation is based on the use by the Niagara Falls Gas and Electric Light Company of 3,000 horse-power, though the amount now distributed by this company is about 100 horse-power. It also includes an estimate of 4,000

horse-power for the Buffalo, Lockport and Rochester Railway Company. This amount is based on a double-track road, while the contract for the construction of the road calls for only a single track at the present time. The company also submitted confidentially a list of corporations which had made inquiries with reference to the purchase of power from the Niagara Falls Electrical Transmission Company, together with the amount of power which they would probably require. This list aggregates 141,000 horse-power. It is needless to say that these inquiries involve no obligation on the part of either party.

THE CANADIAN NIAGARA POWER COMPANY.

16. This company was incorporated by an Act of the legislature of the province of Ontario in 1892, and is not limited by its statutory rights to the production of any given amount of power. All its plans, however, are subject to the approval of the commissioners for the Queen Victoria Niagara Falls Park. The present approved plans were designed for the production of 121,000 horse-power; that is, 11 units each with a capacity of 11,000 horse-power. Regarding one of these units as a spare, so as to put it on the same basis with the two companies previously described, the nominal capacity of the completed plant may be taken at 110,000 horse-power. This company also claims the right to double this plant, basing the claim on that clause of the original charter which limits its occupation of park lands to a length of 1,200 feet, the length of the power-house now designed being 600 feet. As this right has in no way been exercised and as it could not be exercised without the approval of the park commissioners, it need not be further considered.

17. This plant operates under an effective head of 141 feet, and for the development of 110,000 horse-power will require about 9,500 cubic feet of water per second. The head works consist of a head canal with a fore bay of 600 feet wide extending the whole length of the power-house. The headworks, gates, wheel-pit, and tailrace tunnel are completed for the full development. Five gerenating units are completely installed and a portion of the power-house sufficient to cover them has been completed. The transformer station is also of sufficient size to accommodate five units. By its headworks, wheel-pit and tailrace development the company is committed to the installation of 11 units; by its power-house and transformer house to the installation of five units.

18. The books of the company show an investment to July 1, 1906, including liabilities incurred and unpaid for completing the installation of five units, amounting to $6,250,000. For comparative purposes the value of the franchise, given as $900,000, should be deducted, making the cost of the installation $5,350,000. To complete the installation of 11 units would cost probably $1,250,000.

19. This company is an allied company of the Niagara Falls Power Company, and save for the maintenance of a separate organization, is identical with it. It expects to market practically all its power through the Niagara Falls Power Company, or through the latter's agents. An underground conduit, with a capacity of 128,000 horse-power, connects it with the plant of the Niagara Falls Power Company, and cables with a capacity of 32,000 horse-power are now installed. A separate transmission line, capacity 25,000 horse-power, running for 16 miles along the west shore of the Niagara River to Fort Erie is under construction, together with the towers required to carry the cables across the river to Buffalo. For its transmission lines it has actually expended or is committed by contract to the amount of $430,000.

20. It is now delivering 1,340 horse-power to Canadian tenants, who have the option of increasing the amount to 4,237 horse-power. At the present

time there is no definite contract covering the sale of the power intended for delivery in the United States. This is explained by the intimate financial relations existing between the Niagara Falls Power Company and the Canadian Niagara Power Company. At the time of the examination it was actually transmitting to the United States about 16,000 horse-power, but the combined load sheet of the two companies shows that the maximum amount thus far delivered to consumers is about 85,000 electrical horse-power.

INTERNATIONAL RAILWAY COMPANY.

21. This company is incorporated both in the state of New York and in the Dominion of Canada. In its first capacity it owns and operates all the electric railways in the city of Buffalo and adjacent towns, and the city of Tonawanda, Erie county, and the cities of Lockport, Niagara Falls, and the intervening territory in the county of Niagara, N.Y. Under its Canadian charter it owns and operates an electric railway along the shore of Niagara river from Chippawa to Queenston. It also owns two bridges over the Niagara river, one just below the falls and one at Lewiston, over both of which it has specific legislative authority to transmit power.

22. Its power plant is located in the Queen Victoria Niagara Falls Park, which plant was acquired when it acquired the property and franchise of the Niagara Falls Park and River Railway Company. In acquiring this railroad it paid for the equity therein $733,000, and assumed a bonded indebtedness of $600,000, making a total investment of $1,333,000. It is claimed that this value was fixed largely by the power rights of the Niagara Falls Park and River Railway Company. At the time of its acquisition the power plant represented a cash outlay of $141,000. Since that time further expenditures have been made upon its power-house and equipment of $125,000, so that the actual investment of this company in its power property at Niagara Falls, Ontario is about $265,000. With the machinery now installed 3,600 electrical horse-power can be generated, the effective head being 68 feet. Under its charter, none of the power may be sold, and its use is limited to operating and lighting the railway, the Canadian division of which now uses from 800 to 1,200 horse-power. The company claims the right to transmit the balance to the United States for use on that portion of its system. This right, however, is questioned by the commissioners of the Queen Victoria Niagara Falls Park, and in their annual report for 1905 they say that they cannot see their way clear to approve the plans for the transmission of this power through the park. The matter has been referred to the Dominion government for decision. While it is understood that some progress has been made towards a solution, final action has not yet been taken.

23. The company, in its application to transmit power to the United States, asks for 8,000 horse-power, the intention being to enlarge the power plant for this purpose, at an estimated cost of $150,000. Pending the determination by the Dominion government of this company's rights, it is believed that no permit should be granted to them. Having in mind, however, the fact that they are now generating 2,500 horse-power more than they can use on the Canadian side, and the fact that the transmission of this power to the United States would result in an estimated saving of $30,000 a year, it would seem equitable to reserve 2,500 horse-power for the present of the 160,000 horse-power for which permits can be granted, so that a permit for this amount could be issued in case the present controversy is decided in favour of the railway company.

24. The principal facts with reference to the three big Canadian companies are tabulated as follows:

	Ontario Power Co.	Electrical Development Co.	Canadian Niagara Power Co.
Expenditures to date in power plants, exclusive of rights and franchises	$ 5,142,000	$ 4,500,000	$ 4,672,000
Amount required to complete existing contracts and orders	$715,000	$1,760,000	$678,000
Amount required to complete plants to projected size	$6,500,000	$1,576,000	$1,250,000
Effective head, feet	180	135	141
Capacity of generating machinery actually installed, electrical horse-power	42,000	.....	55,000
Nominal capacity of generating machinery installed and ordered, electrical horse-power	66,000	50,000	55,000
Nominal capacity of projected plants, " "	180,000	125,000	110,000
Amount invested and obligated for Canadian transmission lines	a$1,000,000	$2,620,000	a$430,000
Probable sale of power in Canada, horse-power	10,000	30,000	5,000
Amount of water required for machinery installed and ordered, including exciter sets—efficiency of the unit being taken at 76 per cent, cubic feet	4,250	4,300	4,500
Amount of water required for plants as projected, "	11,700	10,800	9,500
Actual expenditures by their associated American transmission companies	$2,785 000	b$246,000	$600,000

25. If these companies were limited in their output to the capacity of the generating machinery now actually installed and ordered, their investment in power plant exclusive of franchises per horse-power developed would be approximately as follows:

Ontario Power Company	$ 89 00
Electrical Development Company	125 00
Canadian Niagara Power Company	97 00

If permitted to develop to the limit of their approved plans the investments in power plant per horse-power developed (nominal capacity) would be:

Ontario Power Company	$ 68 00
Electrical Development Company	62 00
Canadian Niagara Power Company	60 00

These figures must be considered as only approximately correct, owing to the different methods of cost distribution used by the several companies. The aim has been to take the actual cost of the power plants exclusive of rights, rentals and franchises. Regardless of their absolute accuracy, or even their relative accuracy as between the three companies, they serve to show the extent to which the companies by their expenditures and contracts have committed themselves, and also the approximate losses which they will sustain if they are limited to the production of an amount of power less than their projected capacity. All three of these power developments were undertaken in good faith several years ago and long before the agitation in Congress which led to the passage of the present law, and there is no evidence that any of their subsequent transactions were made with the object of securing rights which they had not always intended to claim.

26. The total capacity of the generating machinery installed and ordered for the three plants is 171,000 horse-power. The probable demand in the near future from Canadian markets will not exceed 40,000 horse-power, leaving 131,000 horse-power for sale in the United States. The granting of permits for

a The major portion of this amount has been expended in the construction of transmission lines intended for delivery of power to the United States distributing companies.

b This does not include any expenditures by the Nicholl Syndicate.

this amount would permit the utilization to its full capacity of all machinery now installed or ordered, but would not permit any further development and would not afford a reasonable return on the moneys now invested unless the prices to the consumers were measurably increased In order that such relief as is now possible may be afforded, it is recommended that permits be granted for 157,000 horse-power, the maximum amount under the first limitation, less 2,500 horse-power reserved for the International Railway Company.

27. The conditions surrounding the development of the Canadian power companies differ so materially that an exact statement of their relative rights to the American market is not possible. The Niagara, Lockport and Ontario Power Company, the distributing agent in the United States for the Ontario Power Company, has expended a large sum in opening up a new market. The Electrical Development Company started primarily to develop the Canadian market, and its plans for the American market have not yet been fully matured, while the plant of Canadian Niagara Power Company is virtually an addition to that of the Niagara Falls Power Company. Considering alone the investments in power plant, there is no apparent reason why any distinction should be made between the power companies in the amount of power which they should be permitted to send into the United States. While the projected development of the Ontario Power Company is considerably greater than that of the other two companies, this apparent advantage is balanced by the fact that the other two companies are more fully committed by expenditures already made to complete development. If the relative investments of the three transmission companies associated with them for distribution in the United States are alone considered, the claims of the Niagara, Lockport and Ontario Company are unquestionably superior to those of the other transmission companies. As the object of the law is to restrict, directly or indirectly, the amount of water diverted, it has been suggested that some weight should be attached to the fact that the Ontario Power Company makes greater use of the water that it diverts than either of the other companies. Each of the companies, however, fully utilizes the head incident to its geographical location, and any distinction in the matter of permits based on relative natural advantages would appear to be unjust.

28. The Electrical Development Company had for its primary object the furnishing of power to various points in Canada, as is indicated by the construction of its Toronto line, yet the demand for electrical power in Canada within the economical radius is so limited as to make it unreasonable to suppose that this company had given no thought to the marketing of a part of its power in the United States. The Electrical Development Company is planning to sell between 30,000 and 40,000 horse-power in Canada, which is probably from 20,000 to 25,000 horse-power in excess of what either of the other two companies will sell in Canada, a fact which should receive consideration in fixing the amount to be transmitted to the United States. On the other hand, any greater discrimination against the Electrical Development Company, which is owned almost wholly by Canadian capitalists (the other two companies being owned almost wholly by Americans), may give rise to a feeling of resentment on the part of the people of Canada and tend to retard the negotiation of a treaty between the two countries concerning the preservation of Niagara Falls.

29. The application for permits made by the transmission companies are as follows:—

	Horse-power.
Niagara, Lockport and Ontario Company, from the Ontario Power Company.....	90,000
Electrical Transmission Company, from the Electrical Development Company.....	62,500
Niagara Falls Power Company, from the Canadian Niagara Power Company.....	121,500

The application of the Niagara, Lockport and Ontario Company is based upon the desire to secure a reasonable return on the investment already made, but considering the date named in its contract with the Ontario Power Company for the delivery of the second block of 60,000 horse-power, *i.e.*, January 1, 1911, and having in mind the fact that any production of power in excess of 66,000 horse-power means the construction by the Ontario Power Company of a second conduit and a consequent expenditure of $3,250,000, it is believed that a present limitation to 60,000 horse-power will not work undue hardship.

30. The application of the Electrical Transmission Company contemplates the marketing of one-half of the total output of the Electrical Development Company. Considering the situation of the latter company in the Canadian market and the limited extent to which the Electrical Transmission Company has committed itself by its expenditures, a present limitation to 37,500 horse-power does not appear to be inequitable.

31. The plant of the Canadian Niagara Power Company is intended to supplement that of the Niagara Falls Power Company, and a fair estimate of the rapidity with which its power will be marketed is found in the rate of growth in the past of the Niagara Falls Power Company. This has amounted to about 20 per cent in recent years, with a present output of both companies amounting to 85,000 horse-power. Assuming that the same rate of growth will continue, though in all probability it will be reduced owing to power which the other companies expect to market in this territory, it will be two or three years before the full capacity of the Canadian plant as now installed will be utilized. For these reasons a present limitation to 60,000 horse-power will not, in my judgment, seriously interfere with its normal development.

32. If permits are granted for these amounts, the Ontario Power Company would be justified in installing a seventh unit as a spare, the Canadian Niagara Power Company would be justified in installing two more units, one as a spare, making the nominal capacity of its plant 66,000 horse-power. The Electrical Development Company would be justified in installing three more units, one of them a spare, making the nominal capacity of its plant 75,000 horse-power, half of which, the proportion asked for, it would be permitted to transmit to the United States. If each installs these units, the relative investment in power plant, exclusive of franchise, per horse-power developed (nominal capacity) would be:

Ontario Power Company	$92 00
Electrical Development Company	91 00
Canadian Niagara Power Company	87 00

33. Based upon what precedes, it is recommended that permits for the transmission of power to the United States be issued as follows:—

	Horse-power.
Niagara, Lockport and Ontario Company, from the Ontario Power Company	60,000
Electrical Transmission Company, from the Electrical Development Company	37,500
Niagara Falls Power Company, from the Canadian Niagara Power Company	60,000
	157,500

In order that the various companies may proceed with this limited development, it is further recommended that permits for such amounts as may be authorized be issued without delay.

34. As to the question of granting transmission permits for amounts additional to the first 160,000 horse-power, it is believed to be the intent of the law

to delay the issue of such permits until it is known what appreciable effect, if any, will be produced on the falls by the diversion of the amount of water that will be used under the first limitation. If this interpretation of the law is correct, the granting of such permits will be a matter for the future, as it will be fully a year before the companies will be in a position to develop 160,000 horsepower, in addition to the amounts sold in Canada.

35. The information contained in this partial report was obtained from the parties interested, and its important features verified by a personal inspection of the works and a general examination of the books and records of the various companies. These inspections and examinations were made, July 20 to July 28, 1906, and descriptions of the power plants of the Ontario Power Company (Appendix B), Electrical Development Company (Appendix E), and the Canadian Niagara Power Company (Appendix G), and of the transmission lines of the Ontario Transmission Company (Appendix C), Niagara, Lockport and Ontario Power Company (Appendix D), and the Toronto and Niagara Power Company (Appendix F), in greater detail than in the body of the report, are appended hereto. They were prepared by Mr. Earl Wheeler, E.E., who, with Mr. F. D. C. Faust, a representative of the Department of Justice, assisted in the examination. A photographic copy of a map of Niagara Falls, taken from a monograph prepared in 1904 by the Canadian Society of Civil Engineers, is also appended.*

36. The preparation of that part of the report which concerns the diversion of water on the American side has been delayed by the non-receipt of certain information, and will be submitted later.

Very respectfully,

CHARLES W. KUTZ,

Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,

Chief of Engineers, U.S.A.

APPENDICES.

APPENDIX A.

MEMORANDUM OF THE SECRETARY OF WAR.

WAR DEPARTMENT, WASHINGTON, July 14, 1906.

In the matter of the applications for permits under the Act entitled 'An Act for the control and regulation of the waters of the Niagara River for the preservation of Niagara Falls and for other purposes,' approved June 29, 1906.

On the 5th day of July, 1906, in response to applications by the Niagara Falls Power Company and the Niagara, Lockport and Ontario Power Company, a preliminary hearing was had at Washington, D.C., at the office of the Secretary of War, at which were represented the following companies: Ontario Power Company of Niagara Falls, Gen. F. V. Greene, vice-president; Niagara, Lockport and Ontario Power Company, represented by the firm of Cravath, Henderson & de Gersdorff; Niagara Falls Hydraulic Power and Manufacturing Company, Geo. B. Mathews, president; Niagara Falls Electrical Transmission

*Omitted in this report

Company, Frank A. Dudley, vice-president; Electrical Development Company of Ontario (Limited), represented by H. H. Macrae; Niagara Falls Power Company, represented by F. L. Lovelace, secretary; Canadian Niagara Power Company, represented by F. L. Lovelace; Niagara Falls Trust Company, representing estate of H. E. Woodford, represented by Frank A. Dudley; Albion Power Company, represented by Frank A. Dudley.

Merely general statements were made, and upon the application of Mr. Stetson, counsel for the Niagara Falls Power Company, and Mr. John G. Milburn, counsel for the Niagara Falls Hydraulic Power and Manufacturing Company, and with the consent of the other parties, a subsequent day for a fuller hearing was fixed on the 13th day of July, at the office of the Secretary of War in Washington, and all parties in interest were required to file their applications and claims for permits, whether for diversion of water on the American side or transmission of electrical power from the Canadian side, before the 10th of July with the Secretary of War. Subsequently, and in order that the Secretary of War might visit the *locus in quo*, and understand more clearly the situation, the date of the hearing was changed from July 13 to July 12, at 10 o'clock, in the parlors of the International Hotel at the city of Niagara Falls. Notices of this hearing had been sent to every person known to have any interest whatever in the withdrawal of water from the Niagara river, its tributaries, or the Erie canal, and coming within the provisions and limitations of the law. At the meeting at Niagara Falls the following corporations and individuals were present or represented by counsel.

The Niagara Falls Power Company; the Niagara Falls Hydraulic Power and Manufacturing Company; Canadian Niagara Power Company; the Ontario Power Company of Niagara Falls; Niagara, Lockport and Ontario Power Company; the Niagara Falls Electrical Transmission Company; the Electrical Development Company of Ontario; Albion Power Company; Niagara Falls Trust Company, as executor and trustee of the estate of Henry E. Woodford, deceased; the Niagara Gorge Railroad Company; the Niagara County Irrigation and Water Supply Company; the Lockport Hydraulic Company; the United Box Board and Paper Company; the Lockport Paper Company; the Niagara Paper Mills; Westerman & Company; Arabella A. Peterson; the Electric Smelting and Aluminum Company; International Railway Company; the Cataract Hotel Company; Mr. J. Howard Mason, secretary of the Chamber of Commerce of Buffalo; Mr. J. Horace McFarland, president of the American Civic Association of America.

In addition to the persons making applications for the permits, Mr. J. Horace McFarland, representing the Civic Association of America, which had taken an active interest in securing the passage of the law and in the preservation of the integrity and volume of Niagara Falls, was also present and made argument to the secretary on behalf of the public.

There were present to assist and advise the Secretary of War at this hearing, Brigadier-General Mackenzie, Chief of Engineers, U.S. Army, Brigadier-General Ernst, U.S. Army (retired), and member of the American section of the International Waterways Commission, and Mr. George Clinton, of Buffalo, counsellor at law and member of the American section of the International Waterways Commission.

Every person present desiring to present his claims was heard, and stenographic notes were taken of the arguments and applications, and the hearing continued from 10 o'clock in the morning until 2 in the afternoon.*

*The report of the hearings at Niagara Falls is printed as War Department Document No. 280.

MEMORANDUM OPINION BY THE SECRETARY OF WAR.

The purpose of the law is to preserve the integrity and volume of the Niagara river which goes over the Niagara Falls, and it contemplates the issuing of permits for the withdrawal of water from the river on the American side, and the issuing of another class of permits for the transmission from the Canadian side, and importation into the United States of electrical current generated by water-power plants on the Canadian side. This latter class of permits is required doubtless on the theory that the restriction of the importation of electrical current will have the indirect effect of restricting the use of water for the production of power on the Canadian side of the Niagara river. Speaking generally, there is an investment of capital of about twenty odd million dollars on the American side, and of about an equal amount on the Canadian side, and the effect upon the profit from this investment by the action of the Secretary of War under the law may be very serious. On the other hand, the public interest in and importance of the preservation of the integrity and volume of the Niagara river are shown by the passage of the Act itself, and the very stringent provisions with reference to its violation contained therein.

Congress has deputed to the Secretary of War the task of reaching in his permits an equitable result by which the integrity and volume of the Niagara river shall not be seriously impaired, on the one hand, and the capital which has been really invested and involved in the structures now entered upon and the plant now contracted for and the contracts now made may not be so injured in its profit-producing as that this Act may operate as a practical confiscation of property. Even if Congress had the power by legislation of this character practically to destroy the capital which had been invested in power-producing plants, as to which it is not necessary to express an opinion, I feel certain, from the character of the language used, that it was not the intention of Congress to do so. It becomes of the utmost importance, therefore, before the Secretary of War shall decide upon the permits to be granted, that there should be brought to his knowledge exact information with respect to the capital which has been invested in all the power plants, the extent to which these plants are in actual use, the amount of cubic feet of water actually in use, the amount of electrical power actually generated, the contracts made by these companies for the furnishing of power, the dates when the contracts were made, the charters of the companies and their statutory powers, the extent of horse-power which under their charter of statutory powers they might produce, the amount of actual construction completed, the amount of money invested in partially completed plants, the amount necessary to complete them, the amount of electrical current now being furnished, the amount which can be reasonably furnished with the plant under construction, and the amount that can be sold in the existing markets by these companies and all the other circumstances tending to reflect on the which a limitation by a permit wil have upon their business.

The limitation upon the permits which the Secretary of War is authorized to grant for diversion of water from the Niagra river for six months is 15,600 cubic feet a second. Of that it is undisputed that the Niagara Falls Power Company is now, and has for some time past, been using and selling 8,600 cubic feet per second. It is also undisputed that the Niagara Falls Hydraulic Power and Manufacturing Company has been using 4,000 cubic feet per second. It is also in evidence, and not disputed, that it is engaged in the construction of an additional plant in which it has already expended considerably more than a million dollars under a contract to furnish to the Pittsburg Reduction Company the electrical horse-power from the use of 2,400 cubic feet of water a second. It is also in evidence that the Lockport Hydraulic Company is drawing 500 cubic feet a second from the upper level of the Erie canal, the same level as the level of Lake Erie, carrying it around the locks and discharging it again

into the Erie canal below Lockport; and that the following companies—the United Box Board and Paper Company, Lockport Paper Company, Niagara Paper Mills, Westerman & Co., Arabella A. Peterson, and the Electric Smelting and Aluminum Company—from the next level of the canal below the high level at Lockport are drawing 333 cubic feet of water a second, which they are discharging into Eighteen-mile Creek and thence into Lake Ontario.

As the law has immediate operation, and as none of this water can be withdrawn on the American side without a permit from the Secretary of War, it is of course necessary to prevent the companies from being put in the position of law-breakers by withdrawing the water which it is absolutely necessary to withdraw to maintain the present *status quo*, and temporary permits must be issued for that purpose. Accordingly a temporary permit is hereby granted to the Niagara Falls Power Company to withdraw from the Niagara river 8,600 cubic feet of water per second until further action by the Secretary of War. The Niagara Falls Hydraulic Power and Manufacturing Company is hereby authorized to withdraw 4,000 cubic feet a second until further order of the Secretary of War. This company is not now using the 2,400 cubic feet a second, a permit for which is asked for on behalf of it and the Pittsburg Reduction Company, and it is probable that a final decision may be reached before this order needs to be issued, if it is to be issued at all. With reference to the Lockport Hydraulic Company, a permit will issue for the drawing of 500 cubic feet of water from the Erie canal, and permits will also issue for the use of the 333 cubic feet of water from the lower level of the same canal at Lockport by the persons mentioned above, although in my judgment these permits thus made for 833 cubic feet of water are really duplications so that a permit ultimately for 500 cubic feet of water will cover all the water used by the persons drawing water from the Erie canal in and about Lockport. With respect to the application of the Albion Power Company, I expressed at the hearing the opinion, which I still hold, that its use of the water does not come within the law, and for the present that will be the holding of this department.

With reference to the application of the Niagara Falls Trust Company as executor and trustee of the estate of Henry E. Woodford, deceased, there seems to be no necessity for granting a temporary permit, for the water is not being used, and it is questionable whether a permit is necessary, and, therefore, consideration of this question will be postponed until final decision.

A controversy with respect to permits is likely to arise over the transmission of electricity from the Canadian side, and its importation into the United States. The first limit in the law is the transmission of 160,000 horsepower, and the applicants for permits reach the total of 281,500. These applications are as follows:

Niagara, Lockport and Ontario Power Company (Ontario Power Company of Niagara Falls)....	90,000
Niagara Falls Power Company (Canadian Niagara Power Company).....	121,000
Niagara Falls Electrical Transmission Company (Electrical Development Company of Ontario).	62,500
International Railway Company.....	8,000
	281,500

It is necessary that the Secretary of War should know, before final action is taken by him, in the matter of permits for transmission, the capital already invested in the Canadian companies, the degree of completion of the plant, the amount likely to be sold on the Canadian side of the current, the time when the plant shall be ready for operation, the amount now actually produced, the

amount now actually transmitted to the United States, the amount invested not only in the production of the current, but in the plant and machinery for its transmission, including the poles and wires, and all the details; and also the capital invested by the American companies who are to receive in the first instance the current thus produced, the form in which that capital is, and the contracts into which they have entered both with the Canadian companies and with the companies or persons to whom they expect to sell the current, the dates of these contracts and all the circumstances tending to show the extent of the injury that a refusal to grant the permits requested would cause to the investment of capital, together with the question of when the contracts were made upon which the claims for the use of current are based, with a view to determining the good faith with which these contracts were entered into, and whether the threatened passage of the law induced their making.

For the purpose of advising the Secretary of War upon the facts and circumstances hereinbefore referred to, the importance of which has been pointed out, Capt. Charles W. Kutz, of the Corps of Engineers, under the direction of the Chief of Engineers, is hereby ordered to institute an investigation bearing upon all the questions hereinbefore described. He is authorized, with the approval of the Chief of Engineers, to employ an expert accountant at a reasonable rate of pay to assist him in the examination which he is directed to make, and to incur other necessary expenses to be paid out of the appropriation of $50,000 made by the Act of Congress under which this proceeding is had.

A full report upon the questions presented will be submitted to the Secretary of War through the Chief of Engineers, at as early a date as a thorough investigation and consideration will permit; and this report will thereafter be submitted to the American members of the International Waterways Commission for consideration and recommendation.

So far as I can determine from the statements of fact in the printed applications and in the oral statements, at present electrical current is not being produced on the Canadian side for use upon the American side, except by the Canadian Niagara Power Company and the Ontario Power Company of Niagara Falls. The Canadian Niagara Power Company is producing and transmitting about 16,000 horse-power daily, while the Ontario Power Company is certainly not exceeding this, though the capacity of both companies for production and transmission when the plants which are under construction are completed, as they will be in the near future, will much exceed these amounts. For this reason I hereby grant a temporary permit to the Niagara Falls Power Company to take by transmission from the Canadian Niagara Power Company not to exceed 25,000 horse-power of electrical current daily. I hereby grant a permit to the Niagara, Lockport and Ontario Power Company the right to receive and take by transmission into the United States electrical current equivalent to 25,000 25,000 horse-power daily from the Ontario Power Company of Niagara Falls, Canada. It is thought by the permits hereinbefore granted that the *status quo* will be maintained without injury either to the public or to the private interests concerned.

A copy of this order will be sent to all the parties in interest, including Mr. J. Horace McFarland, president of the American Civic Association.

WM. H. TAFT,

Secretary of War

Appendix B.

THE WORKS OF THE ONTARIO POWER COMPANY OF NIAGARA FALLS.

The present design consists of headworks located in the smooth water of the upper river above the first line of rapids and opposite the Dufferin Islands; three main conduits which lead the water through the park to a point on the cliff below the falls to the valve chamber, thence by penstocks in vertical tunnels through the cliff to a point on a level with the turbines in the power-house, from which point it is carried through horizontal conduits to the turbines; a generating station in which are the turbines and generators; and lastly a distributing station on the high bluff above, to which the electric cables are carried from the generating station in inclined tunnels.

The design that is at present being carried out is for the development of 180,000 electrical horse-power.

THE HEADWORKS.

The headworks consist of an intake proper, an outer fore bay, a screen house, an inner fore bay and gate house. The main intake, which is 618 feet long, consists of concrete piers supporting a continuous reinforced concrete curtain wall, which extends vertically downward 7 feet below the normal surface of the river and within 6 feet of the river bed and upward 5 feet above the normal river level, which has an elevation of about 560 feet above sea level. The intake proper makes an acute angle with the direction of flow of the water in the river of about 30°.

The outer fore bay has for its boundary the original river bank and an artificial island on one side, and the intake and overflow dam on the other. This fore bay has an area of about 8 acres. The gathering wall or overflow dam, except in extremely low stages of water in the river, will be constantly submerged, water spilling freely over it into the river as over a weir. The main portion of the wall has an elevation of 553 feet above sea level. The last 100 feet of this wall adjacent to the screen house is constructed with the top somewhat depressed below the crest of the main portion. This allows a much heavier flow of water adjacent to the screen house for ice-clearing purposes, while it also creates a strong current across the front of the screen. The screen house contains the main screens for the inner fore bay, which screens are in the form of steel grillage set on inclined guides in concrete masonry and are removable by means of an electrical travelling crane. The screens are covered by an artificial stone building, the roof of which forms a broad promenade which is open to the travelling public. The inner fore bay, which extends from the screen house to the gatehouse, has an area of approximately 2 acres. The landward and river walls are partly formed by excavation in the rock and partly by concrete. The elevation of the water in the inner fore bay is 560 feet.

The quantity of water which will be drawn into the inner fore bay when the entire capacity of the plant is to be generated has been estimated to be about 12,000 cubic feet per second. The depth of water at the intake in the outer fore bay is about 13 feet, while at the intake to the gatehouse it increases to approximately 30 feet.

The gatehouse is completed for the three main conduits, one of 18 feet diameter and the other two of 20 feet each. There are installed at present in this building the gate for the 18-foot conduit only. The screens, however, are complete for all three main conduits. The elevation of the centre line of pipes at the head block is 534 feet. The gates and screens are covered by a substantial building, and boilers and steam pipes are installed for heating both screen and gatehouses.

MAIN CONDUITS.

From the gatehouse to the valve chamber, a distance to the nearest penstock of 6,180 feet, there are to be placed three five-tenths inch riveted and reinforced steel pipes, embedded in concrete, one of 18 feet in diameter and the other two of 20 feet in diameter each. The 18-foot conduit is installed and in operation at the present time. This conduit is capable of carrying 3,900 cubic feet of water per second. The fall between the gatehouse and the spillway or valve chamber is 28 feet. The velocity of water in the conduits is estimated to be approximately 15 feet per second. The conduit now constructed is built of steel plates five-tenths inch in thickness with doubled-riveted joints. To secure additional thickness seven deck beams are riveted to the upper part of the plate at intervals of 4 feet throughout its entire length. The pipe is erected in a trench excavated in the park.

From the under side of this conduit 7 penstocks, each 9 feet in diameter, drop through vertical shafts and out through horizontal tunnels in the soild rock of the cliff to the generating station. There are four penstocks installed. Each penstock supplies water for a 10,000 horse-power unit. The vertical distance from the centre of the main conduit to the turbine is 133 feet. From this conduit are also two small penstocks of 30 inches in diameter, each leading through an inclined tunnel to the generating station. They supply water to the two exciter turbines.

The plan of the main valve chamber, which is situated beneath the main conduits, is for three separate chambers, each located below its own conduit and opposite the section of the power-house which it controls. There are to be installed in this valve chamber a 9-foot gate valve and operating mechanism for each penstock. There is excavated at present the complete valve chamber for No. 1 conduit and rough excavation for No. 2 valve chamber, which is back filled. There are installed in No. 1 valve chamber 8 valves, one of which is to be connected in No. 2 conduit. There are 7 valves and penstocks connected to No. 1 conduit. An extra valve is installed on the seventh unit so that it can be operated through either No. 1 or No. 2 main conduits. No. 1 valve chamber is therefore complete for 7 units with the exception of valve motors for three of the valves.

THE GENERATING STATION.

The building is of a flat-roof Egyptian architecture, measuring 76 feet wide, 65 feet high, and for the full capacity will be about 1,000 feet in length. The floor level is 25 feet above the normal level of the river. There is completed at present the structure and foundation of the generating station for 6 units and the excavation for 8 units. The main generators and their turbines, directly connected, are placed on the main floor of the station. Each unit consists of a pair of Francis turbines mounted on a horizontal shaft, operated at 187½ revolutions per minute, and rated at 11,000 horse-power. They are made by J. M. Voith & Co., Heidenheim, Germany. Before reaching the turbine the penstock supplying it divides into two branches, leading to the runners that constitute one complete turbine. The water flows to casings on the outside of each turbine runner, and then inwardly to the common concrete draft tube, which terminates in a tailrace in the foundation of the generating station, which tail-race discharges over a weir wall into the river. The elevation of this weir is 349 feet, and under full-load conditions the water rises to an elevation of 353 feet, giving a gross head between inner fore bay and tail-race water levels about 200 feet. The value of the effective head on the turbines has ranged from 175 to 190 feet. The engineers of the company state that the effective head at full load is 180 feet.

The first three generators are rated at 7,500 kilowatts, 3 phase, 25 cycle, 12,000 volts. The fourth unit is, and the following units will be, of the same voltage, phase, and frequency, but rated at 9,000 kilowatt capacity. The change in capacity of generators is due to the turbines being of a greater capacity than their designed capacity. The generators are of the horizontal, internal revolving field type, having 16 poles. They are made by the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.

On a raised gallery 11 feet above the main floor and extending along the rear wall of the station are located the exciter units and the governors for regulating the speed of the main turbines. There are two turbo-exciter units, each of 300 kilowatt capacity, giving direct current at 250 volts. The turbines of these sets are 600 horse-power capacity, inward-flow type. Each exciter unit has sufficient capacity for exciting 7 generators. Both of these exciters are being run at the present time; one in carrying direct current auxiliary load throughout the plant and the other the exciting load. There are switch-boards installed in the power-house for controlling the two exciter units and one for service requirements in the valve chamber and power-house, which service includes valve motors operation of cranes, arc lighting, elevator purposes, and pumps.

There are installed at present 4 main units of a generating capacity of 42,000 electrical horse-power, 3 of which are complete and ready for developing power. The fourth is complete with the exception of a penstock elbow, which will be installed in a few days. The apparatus and switches for controlling the 2 exciter units are complete and installed. There is remaining space in the present building for 2 more generating units of 12,000 electrical horse-power capacity each. The total capacity of plant under contract is therefore 66,000 electrical horse-power.

THE DISTRIBUTING STATION.

At a distance of 550 feet back from the generating station and on a bluff at an elevation of about 250 feet above it is located the transformer and distributing station. These two buildings are connected at present by one cable tunnel from the power house to the valve chamber and one conduit run from the valve chamber to the distributing station. The main controlling cables and service cables are installed complete for four units. There is on the ground cable for two more units. The capacity of this cable tunnel and conduit run is for 8 generating units. Each generator has two cables in parallel, each a 3-phase cable of paper insulation and lead sheathing, with two spiral tapes, and a jute covering over all serving as armour, each copper conductor being of 250,000 circular mills cross section. The cables are laid in tile ducts embedded in the sides of the tunnel. The building of the distributing station is complete for 12 generating units, 8 at high voltage and 4 at low voltage. The control section is complete for 22 units. The 8 high-tension units are to be placed 4 in each wing; the 4 low-tension units are to be used for distribution at 12,000 volts for the Canadian service, and will be taken through the distributing station on the ground floor of the control section. The upper and central floors of this control section will contain the complete controlling apparatus for 22 units.

There is installed at present in this control section complete control apparatus for 4 units. In an east room the automatic oil switches for the 12,000-volt circuits are mounted in an isolated group for each unit. They are of the 3-pole, vertical magnetically actuated type. The transformers occupy the central room through the length of the building except in the middle, which is the control gallery. Fire-proof masonry walls separate low-tension switch room, control gallery, the two transformer rooms, one in each wing, and the high-tension switch rooms, one in each wing, from one another. There are to be for each unit for

high-voltage service a bank of three single-phase transformers, each having a capacity of 2,500 kilowatts. Each bank of three is set in a concrete pit. They are of the oil-insulated, water-cooled type.

The primaries are delta connected for 12,000 volts, and the secondaries for a voltage of 36,000 volts each, so that when Y connected there is a voltage of 60,000 volts between wires. There are to be three pole high-tension switches of special design to break the maximum current of 10,000 horse-power connecting the secondary coils of the transformers to the high-tension bus bars. The high-voltage transmission circuits will be taken off from the bus bars. There are now installed complete in the central portion of the south wing, four sets of transformers for high-voltage service. The north central wing has no apparatus installed at present. The control section has installed control panels and instrument posts for 4 units, 3 panels suitable for 4 high-voltage lines and 2 low-voltage lines. Each of the latter panels is equipped for two transmission lines. There are also installed a direct-current-service switch board and an alternating current-service switch board for the generating and distributing stations.

Appendix C.

THE ONTARIO TRANSMISSION COMPANY.

The Ontario Transmission Company is the distributing company of the Ontario Power Company, in Canada. The capacity of their transmission lines for Canadian distribution aggregates about 6,000 horse-power.

The lines that are installed or are being installed are the following: One circuit to Welland, a distance of 14 miles, the conductor being a 345,000 circular mils aluminum cable, which is equivalent in cross section to a No. 0000 copper cable; two branch lines from Allanburg, which run to St. Catharines and Thorold, the conductors of which are 70,000 circular mils aluminum, and the transmission line is 9·2 miles in length. These two transmission lines are being designed to deliver power at 12,000 volts. The 345,000 circular mils aluminum line, carrying current at 12,000 volts, has a capacity of 3,000 electrical horse-power, with the assumed drop, while the 70,000 circular mils line, at the same voltage and same drop, has a capacity of 600 electrical horse-power. These transmission lines are wooden-pole structures, being 30 feet high and 175 feet span.

There are also two 12,000 volt, wooden-pole lines running from the distributing station to the international boundary, a distance of 6 miles. The conductors of this circuit are 70,000 circular mils aluminum, which is equivalent to No. 4 copper. The nominal capacity is 600 electrical horse-power. They are intended to supply current for manufacturing interests in Niagara Falls, Ontario, and also for some American delivery at 12,000 volts.

All of these pole lines for part of their distances are constructed on the public high-ways. They are now installed two 60,000-volt individual steel-tower transmission lines from the distributing station to the international boundary, a distance of 6 miles. The conductors of these lines are 820,000 circular mils aluminum, which is equivalent to 500,000 circular mils copper. Each 3-phase circuit has a nominal capacity at the assumed economic drop of 35,000 horse-power.

This line is conducted on individual steel triangular cross-section towers 40 feet in height, with 550 feet span. The conductors are placed so that they form an equilateral triangular cross-section with the apex of the triangle above. The wires are 7 feet apart, and lines are 26 feet 8 inches, centre to centre. These lines are constructed on a private right of way 300 feet wide.

At the Canadian bank of the Niagara river there is a set of high-tension bus bars arranged on poles in the open. Immediately beyond these are installed 3 cantilever structures anchored to the solid rock of the bank, over which structures, the 3-phase circuits are carried to standard steel towers set in concrete on the edge of the river bank below. From these standard towers the circuits are carried to the American side to a similar construction, the wires being approximately 60 feet above the level of the river. Three crossings have been installed.

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Appendix D.

THE LINES OF THE NIAGARA, LOCKPORT AND ONTARIO POWER COMPANY.

From the 3 cantilever structures on the American bank of the Niagara river at the crossing point this company takes the current through a system of bus bars to the switching station. This station at present is under construction, the building only being completed. Between the cantilever terminals and the switching house are installed complete 'Horn' lightning arrester equipments.

From the switching station to the Lockport sub-station, a distance of 16·76 miles, there are constructed two steel-tower transmission lines on a right of way 300 feet wide. This transmission line consists of individual triangular steel towers, each carrying a 3-phase circuit whose conductors are 642,000 circular mils aluminum, having a nominal capacity of 30,000 horse-power with the assumed economic drop.

At Lockport there is a switching and transforming station for the Lockport service. This station has installed three 750 kilowatt transformers, or a total of 3,000 electrical horse-power. The building is constructed for twice this capacity, or 6,000 electrical horse-power.

At this point in the line, a branch line for the Lackawanna Steel Company is taken off. There are being built two 3-phase circuits on a right of way 100 feet wide. The total length of the line is 27 miles. The conductors are 642,000 circular mils aluminum cables, with a nominal capacity of 30,000 horse-power per 3-phase circuit. This transmission line is constructed on A-frame individual steel towers 40 feet in height, with a span of 550 feet. The towers are about 60 per cent installed, while the work of installing the cables was being commenced at the Lockport end.

The Syracuse system does not enter the switch or terminal station at Lockport, but continues on a 200-foot right of way, there being two steel-tower lines constructed at the present time. This tower construction is similar to the construction from the switching station at the international boundary to Lock-

port. Each pole line carries three 428,000 circular mils aluminum cables, with a nominal capacity of 20,000 horse-power. This section of the line runs 11·1 miles east of the Lockport sub-station, at which point (C) it branches into two separate lines on separate rights of way. From point C to Mortimer, a distance of 45½ miles, there is one steel-tower transmission line constructed on a private right of way 200 feet in width, the line being composed of three 428,000 circular mils aluminum cables. From point C there is also a single steel tower line on a 20-foot right of way, to the right of way of the West Shore Railroad, a distance of 9·34 miles, and continuing on the right of way of the West Shore Railroad to Churchville, a distance of 25·4 miles. From point C to Churchville this line is single steel-tower construction carrying three 428,000 circular mils aluminum cables. At Churchville the line crosses the West Shore Railroad and continues on a 50-foot right of way to Mortimer, a distance of 11·25 miles. On this right of way there are two lines under construction, both carrying 428,000 circular mils cables. At Mortimer is intended to be a junction of the main line to the West Shore division line.

From Mortimer to the crossing of the New York Central Railroad, 7·2 miles east of Mortimer, the wooden-pole line carrying 428,000 circular mils cables is continued. At this point the size of the cable falls to 214,000 circular mils aluminum, with a nominal capacity of 10,000 horse-power. From Fairport this line is continued with the same size cable on the right of way of the West Shore Railroad to Syracuse, a distance of 67·95 miles. From Fairport there is intended to be constructed a main line on a right of way somewhat south of the West Shore Railroad. This line will be a one steel-tower line of 428,000 circular mils, to be constructed on a 75-foot right of way 76 miles in length. The right of way is being secured at the present time. This will join the West Shore line at a point just outside the city limits of Syracuse.

It is the practice of this company to place their transmission lines upon the right of way 26⅔ feet from centre to centre, beginning 10 feet from one edge of the right of way. Throughout the approved right of way they have constructed a patrol road and telephone lines, except on some branch lines and on the West Shore Railroad.

THE BRANCH LINES.

There are under construction branch lines from the switching station to Niagara University over an easement right of way a distance of four-tenths of a mile; from the Lackawanna line to Depew over an easement right of way 5 miles in length; from Oakfield to Batavia over an easement right of way 8·6 miles in length; from Mortimer to Geneseo over a private right of way 20 feet wide, the line from Mortimer to Geneseo being 13·4 miles in length and the second branch, to Caledonia, 5·8 miles in length; from Weedsport to Auburn over a 20-foot private right of way 6·5 miles long; and from near Warner to Baldwinsville over a 20-foot private right of way a line 4·6 miles in length.

All of these lines are to be single 3-phase circuits, of No. 4 B & S. copper conductors, erected on wooden poles. The nominal capacity of these lines at 60,000 volts with the assumed economic drop, is estimated to be 3,000 electrical horse-power each.

Appendix E.

THE WORKS OF THE ELECTRICAL DEVELOPMENT COMPANY OF ONTARIO.

The water is diverted for this development at Tempest Point, midway between the headworks of the Ontario Power Company and the Canadian Niagara Power Company. The general design is a gathering dam to gather

the water from the rapids; two fore bays the entire length of the power-house, the inner one of which is under the power-house structure; a wheel pit containing vertical Francis turbines; two tailrace tunnels, joining into the main tailrace tunnel which discharges under the Horshoe Falls.

THE HEADWORKS.

The gathering dam is 785 feet long and its maximum height is 27 feet. It is expected that 3 to 8 feet of water will be flowing over it, depending upon the condition of the river. Adjacent to the power-house the dam is cut away 3 feet below the level of the main crest for a length of 30 feet, so that there will be 3 feet additional depth of water to carry away the ice from in front of the power-house.

The outer fore bay has for its outer wall submerged arches. At the north end of this fore bay is a spillway for the ice and floating materials that pass through the submerged arch curtain wall, to be returned to the river above the falls. In addition to the first line of submerged arches just referred to, a second submerged arch curtain wall has been constructed outside of the racks. This inner fore bay is covered by the main power-house structure. At the north end of this fore bay is a spillway similar in construction and purpose to the one for the outer fore bay. The fore bays and gathering wall are completed for the entire installation. It was expected that water would be turned into the fore bays during the first week of August.

THE SCREEN HOUSE.

The screen house, which is under the main power-house roof, extends the entire length of the building. It is equipped with a travelling crane for handling the screens which set on inclined guides in concrete masonry. Immediately in the rear of these racks are the cast-iron bell mouths, which in turn join to riveted steel penstocks 10 feet 6 inches in diameter, one for each turbine. At the head of each penstock is a vertical electrically operated gate to control the water.

The masonry for this inner fore bay and screen house in complete for the entire installation.

THE WHEEL PIT.

The wheel pit is 416 feet long and 22 feet in width inside of the brick lining, which is 2 feet thick. It is spanned by masonry arches at 3 levels to carry the machinery. Both ends of the pit are also closed by arched wall linings.

TAILRACE TUNNELS.

There are two side tunnels, one on each side of the wheel pit, one for 5 units and one for 6 units. They come together 150 feet north of the wheel pit and merge into the main tunnel. The 5-unit tunnel is 514 feet long, and the 6-unit tunnel is 524 feet long, which lengths are measured from the end of each tunnel to the junction with the main tunnel. These tunnels are each 25 feet deep, of horseshoe cross section, and vary in width from 66 to 30 feet. At the junction the tunnel is 35 feet wide and 25 feet 6 inches high and tapers to a width of 23 feet 5 inches and a height of 27 feet, which section is carried to the edge of the falls, a distance of 1,935 feet. The slope of this main tailrace tunnel is 5·5 feet per 1,000. The velocity of flow is estimated to be about 26 feet per second. The tunnel has a lining 2 feet thick throughout of concrete faced with brick, except for 300 feet at the north end where the lining consists of concrete rings in 6-foot sections, which are expected to break off as the falls gradually wear away.

TURBINES.

There will ultimately be 11 twin vertical Francis internal-discharge turbines, 54 inches in diameter. Their nominal rating is 12,500 horse-power, running at 250 revolutions per minute.

There is a single cast-iron draft tube 9 feet in diameter for each wheel and they discharge alternately underneath the east and west tailrace tunnels. The object of this under discharge is to seal the draft tubes, preventing loss of vacuum, without the necessity for a tailrace weir. By using the two tunnels it is possible to shut off the water entirely from one-half of the wheels without interfering with the other half. A gate has been provided at the end of each tunnel, in case there should be extreme back water in the main tunnel. The wheel pit is not connected to the tailrace, and therefore the hydraulic apparatus can never be flooded out.

There are now being installed 4 turbine units. The turbines are furnished by the I. P. Morris Company, of Philadelphia.

GENERATORS.

The power of the water wheels is delivered to the electrical generators, which are on the ground floor, through vertical shafts 150 feet long, consisting of riveted steel tubes 30 inches in diameter between bearings, and solid shaft 14½ inches in diameter at the bearings. This shaft is held by guide bearings resting on concrete arches. The deck immediately below the generators carries a thrust bearing 37½ inches in diameter, fed by oil under pressure of 350 pounds per square inch. This bearing is sufficient to carry the weight of the entire revolving parts in case of failure from any cause of the water-thrust bearing in the turbine.

There will be eleven 8,000 kilowatt generators of the internal revolving field type, revolving at 250 revolutions per minute. They deliver three-phase alternating current at a periodicity of 25 cycles and potential of 12,000 volts. There are now being installed by the makers, the Canadian General Electric Company, four of these generators.

EXCITER PLANT.

The plan for the exciter installation of this plant is for 2 turbine-driven and 2 motor-driven exciters. The turbine-driven generators are of 300 kilowatts each, giving direct current at 125 volts. The turbines for the two exciters are installed complete. One of the exciter generators is on the ground and the other is being shipped from Peterborough, Ontario. The turbines are built by the I. P. Morris Company, and the generators by the Canadian General Electric Company. Any two of these exciters, either motor or turbine-driven, will excite the entire plant of 11 units.

SWITCH BOARD.

The control switch board for the entire plant, including transformers and transmission lines, is located in the centre of the power-house where the operator can see the entire installation. It consists of an inclosed compartment with a bench board in front. The indicating instruments are on the face of the board, while the recording instruments are on the back. The board is of black enamelled slate, and together with the instruments, is made by the Canadian General Electric Company. Dummy bus bars and signal lamps on the bench board clearly indicate to the operator the connections in the station, and the instruments are so located that each is over the switch that controls it.

The slate of the entire switch board is installed for the entire 11 units. Instruments, switches, &c., for the 4 units and the exciters are on the ground and are nearly installed. The oil switches and their wiring are installed for 2 units, ready for service, and the installation for the other two is being pushed. All the parts of the switches and of the wiring are on the ground and are waiting for the completion of the concrete work before they are installed. The power-house bus bars and generating oil switches, voltage, and current transformers are located immediately below the power-house floor in brick compartments.

POWER-HOUSE STRUCTURE.

The power-house is built of steel and cut stone. It is to be about 500 feet long and 70 feet wide. The height will be 40 feet, except at the centre and end faces. The central bay will give room for the offices of the power company as well as the main entrance, which bay will stand out from the face of the building. This bay will also afford space for the switch-board and auxiliary apparatus.

The contract for the steel and stonework is for two-thirds of the main building, which contract is approximately 50 per cent completed. The steel work is entirely completed at the present time for two-thirds of the building, while the stonework is about 50 per cent completed.

UNDERGROUND CABLE SYSTEM.

The power-house is connected by 4 underground conduits to the transformer house, which is situated upon the hill back from the river, and the buildings are 1,817 feet apart. The design calls for 4 underground conduits, one of which will be in reserve, so that the plant will not be crippled unless 2 conduits simultaneously fail.

At present 2 conduits only are being constructed, each with 16 4½ inch ducts placed 2 wide and 8 deep. The manholes are common to the 2 conduits and are divided into two parts by a central partition, so that one duct system will not be damaged by the burning out of the other. These two conduits are completed except for the crossing of the Ontario Power Company's pipe line, and that will be completed by August 15. At the present time the cable for construction of the four machines is about 75 per cent completed, while all of the cables for these four machines are on the ground.

TRANSFORMER HOUSE.

The transformer house is on top of the bluff outside of the Queen Victoria Niagara Falls Park limits, and is designed to accommodate fifteen 2,670 kilowatt single-phase transformers. These transformers are of the oil insulated water-cooled type, and are wound for 10,000, 11,000 and 12,000 volts primary, and 40,000, 50,000 and 60,000 volts secondary. They will be connected in delta on both primary and secondary windings. The transformer building is completed for the installation of 5 units or 62,500 horse-power.

There is on the ground one bank of three transformers, which are being installed; a second bank of three will be shipped by August 1, and the third bank about August 15, from the makers, the Canadian General Electric Company, of Peterborough, Ontario. It is estimated that the electrical installation of this transformer house is about 43 per cent completed at the present time.

Each transformer is placed in a separate closed fire-proof compartment, so as to minimize the fire risk and prevent the possibility of trouble in one transformer being communicated to others. The transformers are mounted on rails arranged to slide out of the compartments into the gangway, where they can be readily handled by an overhead travelling crane. Piping for oil and water for the transformers is in the basement of the building and in the hall of the transformer compartments.

Appendix F.

TORONTO-NIAGARA POWER COMPANY.

This company, which transmits the power developed by the Electrical Development Company to Toronto, is constructing a transmission line on right of way 80 feet wide from the transformer house above mentioned to Toronto.

The design is for two steel-tower transmission lines, each tower line carrying two 3-phase circuits of 190,000 circular mils copper conductor. These two lines are to be built so that an interurban double-track electric railway can be built between them on the same right of way. The standard distance between poles is 400 feet, there being, however, much longer distances at river and ravine crossings. The height of the standard tower, which is of the A form, is 40 feet above the ground.

There is at present being constructed one of the transmission lines with a capacity of 20,000 electrical horse-power, each 3-phase circuit being designed to carry one half the load, or 10,000 electrical horse-power. The loss of power when each line is transmitting its full load of 10,000 horse-power will be less than 10 per cent, while either line can transmit 20,000 horse-power with less than 20 per cent loss.

This transmission line between the transformer house and Toronto is about 90 per cent completed. It is completed from the Niagara end to Burlington Beach and from the Toronto end to Burlington Beach. There are about three division houses along the line, dividing it into four sections, any one of which can be cut for inspection and repair. A lineman will patrol each section daily after the transmission line is in operation.

Appendix G.

THE WORKS OF THE CANADIAN NIAGARA POWER COMPANY.

The general design of this company is an ice rack on the shore line; a short canal which widens into an outer fore bay the entire length of the power-house; an inner fore bay, screen frames, and penstock gates, all of which are located in a low bay adjacent to the east side of the main power-house structure (the outer wall of this bay being a submerged arch curtain wall); a sluiceway at the north end of the inner fore bay for leading the waste water and ice back to the river above the falls; a wheel pit capable of containing eleven 11,000 horse-power vertical twin turbines, which are directly connected to alternators of the same capacity on the main floor by means of hollow shafting and thrust bearings; a Queenston limestone power-house to cover the wheel pit and house the generators and controlling apparatus, and lastly a tailrace tunnel—horseshoe cross section—which leads the water from the turbines to the lower river.

HEADWORKS.

The power-house is built parallel to the river and about 400 feet from its bank. The water is taken from the river into an outer fore bay through the ice racks and a canal 282 feet in width and 15 feet in depth. The ice rack is constructed on cut-stone piers, eleven in number, on the shore line. It is made of steel rods set at an angle of about 30° from the horizontal. Ninety-two feet back from the ice rack is the five-span stone-arch bridge which carries the tracks of the Niagara Falls Park and River Railway, the carriage road, and sidewalk. Immediately after passing under this bridge, which is 73 feet in

width, the canal widens into a fore bay 600 feet wide, which extends the entire length of the power-house. The headworks are built of massive limestone masonry.

The inner fore bay, screens, and penstock gates are in a low bay adjacent and joining the main power-house structure on its entire east side. The outer wall of this structure is a submerged arch curtain wall, there being two arches for each penstock. The structure, equipment, and masonry of this bay is complete for 5 units, while the masonry of the curtain wall, screen racks, and penstock mouths is also complete for the other 6 units. At the north end of the inner fore bay is an overflow weir which can be used is combination with floating booms to draw floating materials and ice that get into this fore bay back into the river above the falls by means of a sluiceway channel. This channel is 16 feet wide and 300 feet long.

WHEEL PIT.

The wheel pit is 165 feet deep, 18 feet wide inside of the brick lining and 570 feet long. The sides were channeled in 6-foot cuts. There are five chambers for auxiliary machinery excavated in the east side of the wheel pit. The three in the portion of the wheel pit that is used at present are occupied as follows: No. 1, by the three exciter units; No. 2, by the circulating water pumps, for pumping the water that is used for cooling purposes in the transformer house; No. 3. For the oil pumping apparatus. A regulating gate is installed at the end of the wheel pit to maintain the level of the tail water at a sufficient height at all loads to cover the mouths of the draft tubes.

THE TUNNEL.

The tunnel which leads the water from the wheel pit to the lower river is 2,200 feet long and of a horseshoe cross section, 25 feet high and 19 feet wide, being lined with 17 inches of concrete with vitrified brick facing, except for 100 feet at the river end, where the tunnel drops by an ogee curve into the river. This portion is lined with 2 feet of granite, and a massive head wall 60 feet long by 12 feet thick extends from 20 feet below the bottom of the tunnel to 10 feet above it, making a total height of 55 feet, of which 34 is below normal water level. The grade of this tunnel is 7 feet per thousand, which will give the water a velocity when the plant is in full operation of about 27 feet per second. The tunnel is excavated through limestone rock and black shale.

The hydraulic portion of the development of this company, with the exception of the turbines for the remaining six units, is complete for the development of 110,000 electrical horse-power.

POWER-HOUSE.

The power-house structure, as built at present, is complete for five units. It is a one-story structure built of Queenston limestone and roofed with tile. The inner fore bay and screen house are covered by an addition which is supplementary to the main power-house. The building is lined inside with mottled buff brick, enamelled brick, and marble. The main power-house has installed two 50-ton electric cranes for service in the installation of machinery.

HYDRAULIC MACHINERY.

The entire development calls for eleven 11,000-horse-power vertical twin Francis inward-flow turbines. There are five installed. These machines were designed by Messrs. Escher, Wyss & Co., of Zurich, Switzerland. The first three were manufactured and installed by this firm, while the latter two are of

the same design but were built and installed by the I. P. Morris Company, of Philadelphia, Pa.

The water is led to each turbine by means of a single vertical penstock 10·2 feet in diameter, the mouth of which is laid in the inner fore bay behind the screens. Each penstock has its individual electrically operated gate. The water is discharged from the turbines into two draft tubes, one on each side of the pit and discharging into the open tail-race below. The effective head at full load is stated to be 141 feet.

GENERATORS.

The generators are the internal revolving field type, and have a nominal capacity of 8,250 kilowatt. They are designed to run at 250 revolutions per minute, giving 25 cycle, 3-phase current at 12,000 volts. The generators have an efficiency at full load of about 98 per cent and a regulation on full noninductive load of about 8 per cent. The armatures are connected Y, and the neutral is brought out so that it can be grounded if desired. The generators were built and installed by the General Electric Company, of Schenectady, N.Y.

SWITCH BOARD.

From the generators the current is led through varnished cambric, insulated cables to double-throw selector oil switches and thence to the bus bars, of which there are four sets. The switch board consists at present of a generator panels. It is seen from this that each panel is distinct and contains no instruments or switches except those belonging to the particular feeder or generator in question.

The present equipment of the power-house comprises 5 units, and this group and its switch board is considered as a complete plant. The other 6 units are to have an entirely separate switch board, separate exciter plant, and in fact will be a separate plant in itself. This separation is made for the reason that 50,000 horse-power is believed to be as large a block of power as should be under the control of a single switch board and its attendant.

EXCITER PLANT.

The exciter plant is located in a compartment near the bottom of the wheel deck at the turbine deck level. There are three 200 kilowatt, 125 volt D. C. generators, each connected to an independent vertical turbine. Any two of these units will carry the entire direct current load of the plant as at present installed. These exciters are developing at the present time about 200 horse-power, which is used for the excitation of generators and the operation of auxiliary apparatus around the plant. They are, therefore, using about 17 cubic feet of water per second. There are two sets of exciter bus bars, one of which operates the generator fields and the other the D. C. power system, including motors and arc lights. The current is carried up the pit to the main floor of the power-house through a system of vertical copper bars supported every 10 feet.

UNDERGROUND CABLE SYSTEM.

All the power from the power-house is transmitted underground by means of No. 000 B. & S. paper-insulated, 3-conductor, 12,000-volt, lead-covered copper cables. The feeders are divided into two groups. One set leads from the north end of the power-house through Victoria Park and across the upper steel-arch bridge to the plants of the Niagara Falls Power Company, with which they are interconnected. The other group runs south, up the high bank above the power-house, to the transformer-house there located.

There are installed at present 8 underground cables for transmitting power to the United States by way of the upper steel-arch bridge. Each of these cables has a capacity of 4,000 electrical horse-power, making a total cable capacity at present for transmission of power into the United States of 32,000 horse-power. There are conduits laid between the Canadian and American plants, which conduits cross the river at the upper steel-arch bridge and which are designed to contain 32 cables like those already installed, making an aggregate conduit capacity by way of the upper steel-arch bridge of 128,000 horse-power.

There are conduits laid between the power-house and the step-up transformer house, which conduits are capable of containing 32 cables with a total carrying capacity of 128,000 electrical horse-power. It is seen that there is conduit capacity from both ends of the station capable of carrying the entire output of the station if necessary.

TRANSFORMER HOUSE.

The transformer house, which is located on the cliff southwest of the power-house, is constructed for a present capacity of 25,000 horse-power. The building is divided into three sections. The east bay contains all the 12,000-volt switches and bus bars, the central bay contains the step-up transformers only, and the west bay the high-tension switching apparatus. The transformers are of the oil-insulated type, water cooled. The water for cooling purposes will be supplied, normally, from the pumps located in the water-pumping chamber of the wheel pit. There is also installed a stand pipe, 116 feet high by 30 feet in diameter, carrying one day's supply of water to be drawn upon in case of an accident to this pumping system.

There are installed at present twelve 1,250-kilowatt step-up transformers, with a total capacity of 15,000 kilowatts. There are also four step-down transformers of 250-kilowatt capacity each, having a total capacity of 1,000 kilowatts. The former transformers have a voltage ratio of 12,000 to 24,000 or 36,000, or 41,500, or 62,600 volts. The 250-kilowatt step-down transformers have a ratio of 11,000 to 2,200 volts. The latter are used for supplying the local distributing service in Canada. There is space available for three more 1,250-kilowatt step-up transformers, making the total capacity for transmission purposes at 24,000 volts, 25,000 horse-power. This 'step-up' transformer equipment is designed for supplying current to the Fort Erie-Buffalo transmission line at 24,000 volts pressure.

TRANSMISSION LINES.

There are now installed in Canada a 2,200-volt overhead line for local distribution, consisting of a pole line aggregating about 4 miles in length and containing two 3-phase circuits; eight underground cables for transmitting power into the United States by way of the upper steel-arch bridge, and one 24,000-volt 25,000 electrical horse-power transmission line to Buffalo, which line is now being built by way of Fort Erie, and will be ready for service about September 15.

This transmission line will consist of two lines of iron-anchored poles, 40 feet high, spaced 300 feet apart, and will carry two 3-phase aluminum circuits, each conductor of which is a 37-strand cable having a cross-section of 500,000 circular mils. These lines are built on a private right of way, 30 feet wide, extending from the transformer house to the river front at Fort Erie. The ultimate capacity of this line is 50,000 horse-power, which will be carried on two pole lines on this 30-foot right of way, each line carrying two circuits, each circuit having a nominal capacity of 12,500 horse-power at 24,000 volts. The

estimated loss in transmission is about 7 per cent. The line is 16 miles in length.

The poles consist of two 4-inch wrought-iron pipes joined together at the centre by a casting which has four struts, 90° apart, projecting radially. Truss rods secured at the top and bottom of the poles pass over the ends of these struts, and when tightened up stiffen the jointed pipe. The function of this central tubular member is to resist downward compression only. The horizontal stresses on the pole are resisted by four guy rods anchored in the ground with concrete guy stubs, one of these guys being in each quadrant around the pole. Under the central member of the pole is placed a heavy block of concrete which carries the iron step for the central pipe and takes the thrust.

The insulators are made of a compound known as 'electrose.'

At Fort Erie the line is tapped by a connection to a local substation for the supply of power to that municipality. The line then rises from the standard 40-foot elevation to a tower 80 feet high, erected about 1,200 feet from the Canadian shore line of the Niagara river. Thence the line rises again by a single span of 1,200 feet to a tower 210 feet in height on the river bank; thence by another single span of 2,300 feet the line passes to the Buffalo side of the river to another 210-foot tower. From there it drops down to a new 50,000 horse-power terminal house constructed for the distribution of this power in Buffalo. The tension is held the same at all conditions of wind and weather by means of strain insulators and heavy weights at both ends of the span.

Report upon the Water Power Situation at Niagara Falls as Concerns the Diversion of Water on the American Side, by the American Members, November, 15, 1900.

INTERNATIONAL WATERWAYS COMMISSION,

OFFICE OF THE AMERICAN SECTION,

BUFFALO, N.Y., November 15, 1906.

Mr. SECRETARY: The American members of the International Waterways Commission have the honour to return herewith the report, dated October 5, 1906, by Capt. Charles W. Kutz, Corps of Engineers, United States Army, upon the subject of permits for diverting water on the American side at Niagara Falls, referred to them by your indorsement of October 13.

In our report dated September 29, 1906, we gave a brief description of the four kinds of permits authorized by the Act approved June 29, 1906, and we concurred in the recommendations contained in Capt. Kutz's report of August 15, 1906, which referred to permits of the third kind, or those for transmitting electrical power from Canada into the United States to an aggregate amount of 160,000 horse-power. The report by Capt. Kutz now under consideration refers to permits of the first kind, or those for diverting water from the Niagara River on the American side to an aggregate amount not exceeding 15,600 cubic feet per second.

The conditions prescribed in the law for this kind of permits are that—

1. They must be issued 'to individuals, companies, or corporations which are now actually producing power from the waters of said river or its tributaries in the State of New York or from the Erie Canal.'

2. The amount of water to be allowed must not exceed that 'now actually in use or contracted to be used in factories the buildings for which are now in process of construction.'

3. The amount to be allowed 'to any one individual, company, or corporation as aforesaid' must not exceed 8,600 cubic feet per second.

4. The total amount to be allowed 'to all individuals, companies, or corporations as aforesaid' must not exceed an aggregate of 15,600 cubic feet per second.

Applications have been received from the Niagara Falls Power Co. for a permit to divert 8,600 cubic feet per second, from the Niagara Falls Hydraulic Power and Manufacturing Co. for a permit to divert 6,400 cubic feet per second, and from numerous industries at Lockport and at Medina, using small quantities of water from the Erie Canal.

After a careful examination of all the circumstances which should affect a decision as to the amount of water to be allowed under the Act, including the capital invested, the present capacity of the works and their present output, the quantity of water now actually in use, the contracts made for furnishing power, with the dates of such contracts, the future capacity of the works as projected, and charter rights under New York State law, Capt. Kutz reaches the conclusion that a permit should be granted to the Niagara Falls Power Co. for the maximum amount allowed, viz, 8,600 cubic feet per second. He finds that the company and its tenants have that amount actually in use, and may reasonably ask for the whole of it, and in that opinion we concur. He is in doubt whether it should include the water which is occasionally used for sluicing debris and ice. The amount of this is not accurately known, but it is estimated at between 600 and 700 cubic feet per second during the sluicing process. It is used only intermittently. The total amount thus used in a year, would, if distributed throughout the year, be but a small average per second. The law is explicit in prohibiting a permit for any amount whatever in excess of 8,600 cubic feet per second, but it seems a reasonable interpretation to take that as the general average and to allow the company to use a slightly less amount during the greater part of the year in order to accumulate enough water to supply the demands of sluicing upon the occasions when it is needed.

After a similar careful examination of all the circumstances relating to the Niagara Falls Hydraulic Power and Manufacturing Co. Capt. Kutz reaches the conclusion that a permit should be granted that company for the diversion of 5,743 cubic feet per second, exclusive of the amount required for sluicing, or for 6,403 cubic feet per second if the water for sluicing be included. The latter is estimated at 660 cubic feet per second. It seems to us desirable that the permits to the two companies should resemble each other in their provisions for sluicing. If to the 5,743 cubic feet per second just mentioned there be added 107 cubic feet per second as an average for sluicing, an allowance will be made for the accumulation of water which will provide 660 cubic feet per second for sluicing during $116\frac{2}{3}$ hours of each month, or 59 days in each year, an allowance which is ample. Under this arrangement the amount to be granted to this company for the use of itself and its tenants would be 5,850 feet per second.

The industries using water from the Erie Canal are numerous, and the quantity of water diverted is comparatively small. At Lockport 27 persons or corporations are using water taken either from the upper or the lower level. It is understood that most of the water from the upper level is returned to the canal; but the arrangement of tunnels is such that the water has two outlets and it is impossible to determine what portion is permanently diverted into Eighteen-mile Creek. Many of these industries are located one below the other on Eighteen-mile Creek, and use the same water successively, taking it from the

lower level. The quantity of water permanently diverted from the canal at Lockport is found from measurements taken above and below all diversions to be upon an average 193 cubic feet per second.

Industries at Medina, N.Y., use about 165 cubic feet per second. The number of the industries is not given, but it is understood that they are in general of about the same magnitude as those at Lockport.

The total amount of water diverted from the Erie Canal is, therefore, 358 cubic feet per second, and the number of industries using it is between 30 and 40. Many of these industries have made application for permits, but many others have not, and of those applying many use the water which has previously been used by one or more others. Manifestly there is difficulty is apportioning the proper amount among so great a number. After apportionment there would be difficulty in the enforcement by the Federal authority of the provisions of the permits if granted. The canal is owned by and is under the exclusive control of the State of New York. The State engineer protests against the granting by the United States of any permit which shall impose an obligation upon the State. Capt. Kutz suggests that the difficulty may be met by treating all these industries as tenants of the State and granting the permit to the State, as it is proposed to provide for the tenants of the Niagara Falls Power Co. and of the Niagara Falls Hydraulic Power and Manufacturing Co. by permits to those companies. He recommends that a permit for the diversion of 358 cubic feet per second be granted to the State of New York.

The objections to this course are that the State of New York has not applied for a permit and might perhaps not be willing to accept one, and it is a somewhat forced interpretation of the law to include the State among the 'individuals, companies, or corporations which are now actually producing power' to whom the privilege must be restricted. It is our opinion that the person first using the water after it leaves the canal should have a permit, directly from the Secretary of War, and that persons using it afterwards may be allowed to do so without a permit. The information necessary for the issuance of these permits is not now at hand. We have taken steps to secure it, and if the honourable Secretary of War concurs in the opinion just expressed we propose to submit a supplementary report upon the subject as soon as possible hereafter.

We accordingly recommend that permits for the diversion of water from the Niagara River be granted to the Niagara Falls Power Co. for 8,600 cubic feet per second and the Niagara Falls Hydraulic Power and Manufacturing Co. for 5,850 cubic feet per second, it being understood that these are average amounts and that the larger amounts occasionally required for sluicing may be accumulated by using generally smaller amounts.

Yours very respectfully,

O. H. ERNST, *Chairman.*

GEORGE CLINTON, *Member.*

E. E. HASKELL, *Member.*

Hon. W. H. TAFT,

Secretary of War.

SESSIONAL PAPER No. 19a

Report of Capt. Charles W. Kutz, Corps of Engineers, upon the Water Power Situation on the American Side of Niagara Falls.

War Department,
Office of the Chief of Engineers,
Washington, October 5, 1906.

General,—1. Referring to the orders of the Secretary of War, dated July 14, 1906, in reference to the power situation at Niagara Falls, and to the report dated August 15, 1906, in reference to the Canadian power companies, and their associated transmission companies, I now have the honour to submit a report in reference to those companies seeking permits to divert water on the American side.

2. The law limits the present granting of permits for diversion to those individuals, companies, or corporations which are now using water for power purposes from the Niagara River, or its tributaries, or from the Erie Canal.

3. The only companies coming within the scope of the Act of Congress are the Niagara Falls Power Company, the Niagara Falls Hydraulic Power and Manufacturing Company, and numerous small industries at Lockport and at Medina, N.Y.

4. Upon request, the two large companies prepared specific replies in writing to each of the questions propounded by the Secretary of War, and copies of these replies are appended hereto, marked Appendix I and Appendix J.

THE NIAGARA FALLS POWER COMPANY.

5. This company was created, organized, and continued by six Acts of the legislature of the State of New York, as follows: Chapter 83 of laws of 1886, chapter 489 of the laws of 1886, chapter 109 of the laws of 1889, chapter 253 of the laws of 1891, chapter 513 of the laws of 1892, and chapter 477 of the laws of 1893. In section 2 of one of these Acts (chapter 513, laws of 1892) it is provided—

> 'that nothing contained therein or in any of the former Acts concerning said corporation shall be so construed as to confer an exclusive right nor any right to infringe upon the State reservation, or to obstruct the navigation of the Niagara River, or to take therefrom more water than shall be sufficient to produce two hundred thousand effective horse-power.'

6. The general construction adopted by this company for utilizing the energy of the Falls is as follows: A short canal has been excavated at a point about 1 mile above the Falls on the American side, its direction being approximately at right angles to the river; this canal is 250 feet wide at the mouth, narrowing to 100 feet at its upper end; its depth is about 12 feet. Two power houses have been constructed on opposite sides of this canal. The water is carried by the means of penstocks to the turbines which are installed near the bottom of the two wheel pits under the two respective power houses. After leaving the turbines the water is discharged into a horseshoe-shaped tunnel with an area equivalent to that of a circle 21 feet in diameter, which carries it to the lower river, a distance of about 7,000 feet.

7. In power house No. 1 the turbines discharge their water into the tailrace openly without draft tubes. In power house No. 2 draft tubes are used, making the theoretical effective head 144 feet in power house No. 2 as against 136 feet in power house No. 1. These power houses have a combined generator capacity of 105,000 horse-power.

8. In addition to the above, water is supplied from the intake canal to the International Paper Company and to the pumping plant of the Niagara Falls Water Works Company.

9. As a result of more or less recent tests made by the engineers of the power company, it was determined that an average in the two power houses of 0·101 cubic foot of water per second was required to develop 1 electrical horse-power at the switch board. If this determination is correct, the development of 100,000 electrical horse-power, the nominal capacity of the plant, would require 10,100 cubic feet of water per second. This amount exceeds by 1,500 cubic feet the amount computed as necessary under the assumed efficiency of the turbines and the theoretical effective heads noted above. This difference is due to certain defects in the design, the tail water in the two wheel pits standing at such a level as to materially affect the effective head.

10. The plant of the International Paper Company, one of the power company's tenants, consists of 6 turbines, each rated 1,600 horse-power, and 2 centrifugal pumps, representing about 69 horse-power. The amount of water used by this company was determined by test made in 1904, using a current meter placed at various points in a given cross section of the paper mills headrace. These measurements were taken with an average of 87 per cent of gate opening, and showed a flow of about 660 cubic feet per second, or about 750 cubic feet per second with full gate opening.

11. The hydraulic plant of the Niagara Falls Water Works Company consists of two Pelton water wheels, each rated at 400 effective horse-power, and the amount of water used does not exceed 75 cubic feet per second. The officers of the Niagara Falls Power Company are of the opinion that the use of water by the Water Works Company for developing power to run their pumps is exempted from the prohibition of diversion on the ground that it is indirectly used for domestic and sanitary purposes.

12. Deducting the amounts used by its tenant companies, 825 cubic feet per second, from the maximum amount for which a permit can now be granted to any one individual, company, or corporation, that is, 8,600 cubic feet per second, there remains 7,775 cubic feet a second for use in the power plant. Again, deducting the amount used in the exciter turbines, stated to be 35 cubic feet per second, and using the ratio obtained from the company's tests above mentioned, the maximum electrical output of this company is limited by law for the present to 76,630 electrical horse-power.

13. This limitation does not take into consideration the water that is occasionally used for sluicing debris and ice, the amount of which is not known. It is questionable whether water used for this purpose should be included in that for which a permit is considered necessary. Such use is intermittent, and it is practically impossible to determine the amount used at any given time. The Niagara Falls Hydraulic Power and Manufacturing Company estimates that 660 cubic feet per second is at times required for this purpose. If it be determined that water used for sluicing ice must be included in the amount covered by the permit, the mid-winter electrical output of this company will be still further curtailed.

14. The maximum output of this company during the week preceding that in which the examination was made was 64,800 horse-power, while the average of the maximum weekly loads since October, 1905, was 73,000 horse-power.

15. The company in its statement includes a list of contracts for furnishing power in which the optional amounts aggregate 167,000 horse-power. Of this amount 102,550 horse-power has been called and is now in use. These contracts cover the output of both this plant and that of the Canadian Niagara Power Company. The amount called for represents the sum of the maximum amounts of power used by their tenants. These peakloads never occur simultaneously,

and the actual peak electrical load generated up to date by the American and Canadian plants combined has been about 85,000 horse-power.

16. The books of this company show an investment in power plant of $13,500,000. This amount is largely in excess of what it would cost to reproduce it, as it is evident from the investments now being made on the Canadian side. It is also evident from the estimate of $7,000,000 given as the amount required to increase the capacity of the plant to the statutory limit—that is, 200,000 effective horse-power. This large investment, $135 per horse-power developed, is partly accounted for by the fact that this company was the pioneer in this method of utilizing the power of Niagara Falls, but it can not fairly be said to be due to investments made with the object of doubling the capacity of the plant. The intake is probably larger than necessary for the development of 100,000 horse-power, but the rest of the plant was designed for that amount. Notwithstanding this large investment, the books of the company show that its net earnings after paying interest on its bonded debt and all other fixed charges, now amount to 9 per cent on its outstanding capital stock of over $4,000,000.

17. This company is entitled by reason of its contracts to the fullest consideration that is now possible under the law—i. e., a permit for the diversion of 8,600 cubic feet per second. Such a permit will practically limit the company to its present output and will not allow any growth, but if this company is allowed to receive from the Canadian Niagara Power Company the amount recommended, 60,000 electrical horse-power, the normal development of the two companies considered as one will not be seriously interfered with.

THE NIAGARA FALLS HYDRAULIC POWER AND MANUFACTURING COMPANY.

18. This company was chartered under the laws of the State of New York in 1878, and subsequently, by an Act of the legislature of the State of New York, known as chapter 968, laws of 1896, its rights were confirmed. In this confirmatory act the company was limited and restricted to the use of 'such quantity of water as may be drawn by means of the hydraulic canal of said company when enlarged through its entire length to a width of 100 feet and to a depth and slope sufficient to carry at all times a maximum uniform depth of 14 feet of water.' This limitation is more or less indefinite, but the capacity of such a channel has been computed to be 9,500 cubic feet per second without material diminution of the head.

19. The canal leaves the Niagara River about 1 mile above the Falls and extends through the city to a point about one-half mile below the Falls, where the power houses of the company are situated.

20. It is being widened and deepened to the maximum authorized dimensions. The widening down to the water surface has been completed, except at two points, where work is now in progress. A great deal of work has also been done toward giving it a uniform depth of 14 feet throughout the width of 100 feet, but this work has not been completed.

21. The company disposes of its power in three ways. First, it sells water to six corporations, who develop power with their own machines. This water is used under heads varying from 50 to 125 feet, with an average head, considering the quantities used at each elevation, of about 90 feet, or less than one-half of the maximum effective head. The amount of water so furnished is computed to be 1,332 cubic feet per second. In power house No. 2 (No. 1 being obsolete), situated on the river bank at the foot of the bluff, the company develops 32,000 mechanical horse-power, using for the purpose 2,011 cubic feet of water per second under an effective head of 200 feet. Of this amount 27,368 mechanical horse-power are sold to customers, who convert it into elec-

trical power by the use of generators attached to the power company's turbines. The remaining power developed in power house No. 2 is converted into and sold as electrical power. For several years past the company has been engaged in the further development of its water-power, and now has under construction a forebay capable of furnishing sufficient water, when the canal has been widened and deepened to the extent authorized by law, to develop practically 100,000 additional horse-power. As stated above, much of the necessary enlargement work on the canal has been completed, the greater part of the excavation for the power house itself has been completed, the forebay is under construction, and intakes leading to the penstocks, with their corresponding gates and valves, are being installed for the complete development.

Of the amount to be developed in power house No. 3, 36,000 horse-power is for use of the Pittsburgh Reduction Company, a contract for its sale having been entered into on the 20th day of November, 1905. For developing this amount there will be required about 2,400 cubic feet of water per second. As the conditions laid down by the Act of Congress have been complied with so far as this additional development is concerned, it is recommended that the necessary permit be issued. In the statement furnished by the company as to the water now in use, there is included 660 cubic feet per second for sluicing debris and ice. It is questionable whether this amount should be included in that for which a permit is considered to be necessary. Such use is intermittent, and it is practically impossible to determine the amount used at any given time. If the diversion of water for this purpose does not require a permit, this company is entitled under the law to a permit for 5,743 cubic feet per second, being the amount now actually in use and contracted to be used in factories in process of construction. If the water used for sluicing ice and debris must be included the permit should be for 6,403 cubic feet per second.

22. The settlement of this question will not affect the Niagara Falls Hydraulic Power and Manufacturing Company, but will affect the output of the Niagara Falls Power Company.

23. The investment represented by the plant of the Niagara Falls Hydraulic Power and Manufacturing Company is $5,600,000. This included $1,400,000 expended or obligated for work on the canal and in connection with power house No. 3. It is estimated that $1,500,000 additional will be required for completing the canal and power house No. 3.

24. While the granting of a permit to this company for the diversion of 6,400 cubic feet per second will enable it to meet its contract obligations, it will not permit it to take the full advantage of the investment already made nor allow for any growth. The investment that will be rendered useless is roughly estimated at $290,000 for the canal and $360,000 for power house No. 3.

INDUSTRIES USING WATER FOR POWER PURPOSES DERIVED FROM ERIE CANAL AT OR NEAR LOCKPORT, N.Y., AND AT MEDINA, N.Y.

25. In 1826 the State of New York leased to Richard Kennedy and Junius H. Hatch so much of the waters of the Erie Canal as could be spared from the canal at the head of the locks at Lockport at an annual rental of $200. The lease referred to was perpetual and in 1856 it, or the principal part of the rights under it, came into the hands of the Lockport Hydraulic Company, which has since then operated the lease. The lease provides that the water so used shall be discharged into the lower level at such place and in such manner as the State canal commissioners shall from time to time deem most advisable for the security of the canal and for the convenience of the navigation thereon.

26. In an investigation of this matter made in July by the secretary of the American section of the International Waterways Commission it was developed

that the arrangement of tunnels in Market street near Exchange street was such that the water drawn from the hydraulic race could find its outlet either into the canal or through the culvert to the mill pond and eventually down Eighteen-mile Creek, thus making it impossible to determine what portion of the water supplied to these mills is permanently diverted from the canal, though it is understood that as a rule it is all returned to the canal. In the application filed with the Secretary of War by the Lockport Hydraulic Company the amount of water used by its tenants and delivered to the lower level is stated to be approximately 500 cubic feet per second, whereas Mr. Henry A. Van Alstyne, New York State engineer and surveyor, is authority for the statement that 350 cubic feet per second is the amount taken from the upper level and returned to the lower level of the canal. In a subsequent letter from the attorney for the Lockport Hydraulic Company it is learned that the amount named in the application represents the maximum quantities covered by the company's leases, and further that it includes the amount of water required to operate the machinery of the Holly Manufacturing Company's plant not now in actual operation, but which was used for more than twenty years prior to 1904, and which then developed 150 horse-power.

27. In addition to the industries which obtain their water through the Lockport Hydraulic Company there are a number of large manufacturing plants being operated at the city of Lockport by power produced from the surplus water of the canal spilled from the canal below the locks and used successively in the progress of the water down the channel of Eighteen-mile Creek. The use of the water spilled from the lower level of the canal is not covered by any contract with the State of New York, and it is understood that the State of New York derives no revenue from it. Furthermore the State engineer and surveyor, Mr. Henry A. Van Alstyne, protests against the granting of any permit by the United States to parties using water spilled from the canal, on the ground that it will impose an obligation of the State of New York to furnish the amount of water covered by the permit, an obligation which does not now exist.

28. To supply losses due to evaporation and leakage it will probably be necessary under any circumstances to pass a certain amount of water around the locks from the upper level to the lower level, so that the amount so transferred does not appear to have any particular bearing on the subject of this investigation. The real question to be determined is the amount of water that is taken from the canal for power purposes and not returned thereto.

29. Reliable gaugings made under the direction of the State engineer and surveyor of the State of New York show that the average amount of water flowing eastward in the Erie Canal in the rock cut at the city of Lockport above all points of diversion of water for power is 805 cubic feet per second and that the flow in the canal below the locks at Lockport and below all points where water is diverted for power or other purposes is 612 cubic feet per second, so that there is diverted from the canal in the city of Lockport 193 cubic feet per second. This includes both the water diverted for power and the water passing over the canal spillway.

30. As all water used at Lockport, whether permanently diverted from the canal or whether transferred from one level to a lower level of the same canal, is brought from Lake Erie in a waterway constructed and paid for entirely by the State of New York, it would seem that any permit granted by the United States for the diversion of water from the Erie Canal should be granted not to the individual users, but rather to the State of New York The same principle is followed in the case of the Niagara Falls Power Company and the Niagara Falls Hydraulic Power and Manufacturing Company, each of which owns its intake canal and has tenants taking water therefrom, though the permit is granted for the full amount to the owner of the intake canal.

31. Conflicting information has been received concerning the amount of Lake Erie water that is taken from the Erie Canal by the spillway and gates at Medina, N.Y. Mr. Franchot, the superintendent of public works, State of New York, stated, under date of July 17, that he believed the amount of water fed into the canal from Oak Orchard Creek and Genesee River was practically equal to the amount abstracted from the canal, while Mr. Bond, the chairman of the advisory board of consulting engineers, State of New York, is authority for the statement that the Oak Orchard feeder supplies in low years only 10 cubic feet per second, while the amount abstracted is about 175 cubic feet per second. Assuming the latter information to be more nearly correct, the maximum amount of Lake Erie water diverted from the canal at this point is 165 cubic feet per second. The total amount of Lake Erie water that is permanently diverted from the Erie Canal at times of minimum flow in the feeder is therefore 193 plus 165, or 358 cubic feet per second, and it is recommended that a permit for this amount be issued to the State of New York.

32. If it be determined that the amount of water occasionally used for sluicing debris and ice must be included in any permits that are granted, the interested parties are, in my opinion, entitled under the law to permits for diversion as follows:

	Cubic feet per second.
Niagara Falls Power Company	8,600
Niagara Falls Hydraulic Power and Manufacturing Company	6,403
State of New York	358

33. Descriptions of the power plants of the Niagara Falls Power Company and the Niagara Falls Hydraulic Power and Manufacturing Company in greater detail than is given in the body of the report are appended hereto, marked Appendix K and Appendix L. They were prepared by Mr. Earl Wheeler, electrical engineer, who assisted in the examination.

Very respectfully,

CHARLES W. KUTZ,
Captain, Corps of Engineers.

Brig. Gen. A. MACKENZIE,
Chief of Engineers, U.S.A.

APPENDICES.

Appendix I.

STATEMENT OF THE NIAGARA FALLS POWER COMPANY.

[Before the Secretary of War, in the matter of the Niagara Falls Power Company for a permit for the diversion of water in the United States from the Niagara River.]

In reply to your letter under date of July 23, 1906, the Niagara Falls Power company submits the following items of information:

(1) *Capital Invested in Power Plants. $15,469,974.92.*

This amount included an investment of substantially $2,000,000 in lands used by the company for manufacturing sites for the location of power tenants and for the location of its power plants. A statement in such detail as is possible is submitted herewith.

(2) *Extent to which plants are in actual use.*

(*a*) Power house No. 1, with a capacity of 50,000 horse-power; all in use.

(*b*) Power house No. 2, with a capacity of 55,000 horse-power; all in use.

(*c*) The hydraulic power plant of the International Paper Company, with a capacity of 8,600 horse-power, substantially all in use.

(*d*) The hydraulic power pumping plant of the Niagara Falls Water Works Company, with a capacity of at least 500 horse-power, substantially 500 horse-power of which is in use.

The plants named in (*c*) and (*d*) are parts of the power development made by the Niagara Falls Power Company, and the application herein to the Secretary of War was made in behalf of the said power tenants, as well as in behalf of the Niagara Falls Power Company and its other power tenants.

(3) *The Amount of Cubic Feet of Water actually in use, 8,600 cubic Feet per Second.*

(See report of International Waterways Commission, S. Doc. 242, sec. 9, p. 5; sec. 30, p. 11.)

(4) *Amount of Electrical Power actually generated.*

The amount of electrical power actually generated by the Niagara Falls Power Company is substantially 90,000 electrical horse-power maximum. In addition thereto substantially 9,000 horse-power in the form of hydraulic power is generated by its said power tenants, operating under its rights for power development.

(5) *Contracts made for the Furnishing of Power, with the Dates when such Contracts were made.*

The following contracts are now in force between the Niagara Falls Power Company and its power tenants.:

Tenant.	Date of contract.	Horse-power subject to call.
Acetylene Manufacturing Co	Apr. 29, 1903	100
Acheson Siloxicon Articles Co	Dec. 1, 1905	80
Buffalo and Niagara Falls Electric Light and Power Co	July 1, 1304*	2,000
Carborundum Co	May 1, 1903*	10,000
Castner Electrolytic Alkali Co	May 13, 1901*	8,200
Cataract Consumers Brewery	May 2, 1904	200
Cataract Power and Conduit Co	June 1, 1896	50,000
Composite Board Co	June 2, 1902	200
Development and Funding Co	June 1, 1905	6,500
Electrical Lead Reduction Co	June 1, 1900	500
Francis Hook and Eye and Fastener Co	Jan. 1, 1900	20
International Acheson Graphite Co	May 1, 1904*	3,200
International Paper Co	Mar. 7, 1896	8,600
International Railway Co. (North Tonawanda)	Dec. 30, 1905*	8,800
International Railway Co. (Niagara Falls)	Dec. 30, 1905*	1,500
Lockport Paper Co	Dec. 30, 1905	2,400
Natural Food Co	Feb. 1, 1901	2,50
Niagara Electro-Chemical Co	Jan. 1, 1896	3,400
Niagara Research Laboratories	Apr. 30, 1903	500
Niagara River Manufacturing Co	June 1, 1905	5,000
Niagara Tachometer and Instrument Co	Feb. 16, 1906	15
Niagara Falls Water Works Co. (hydraulic power)	Oct. 1, 1896	500
Niagara Falls Water Works Co. (electric power)	Oct. 1, 1896	50
Norton Emery Wheel Co	Jan. 15, 1906*	3,400
Oldbury Electro-Chemical Co	Dec. 1, 1898	.....
" "	Mar. 1, 1899	3,000
Ozone Vanillin Co	July 1, 1902	100
Phosphorus Compounds Co	Apr. 30, 1903	100
The Pittsburgh Reduction Co	May 1, 1905*	.....
" "	July 20, 1906†	9,500
Ramapo Iron Works	Oct. 1, 1903	800
Roberts Chemical Co	May 1, 1900	500
Suburban Power Co	Feb. 7, 1906	75
Tonawanda Power Co	June 1, 1898	10,000
Union Carbide Co	Nov. 1, 1898	25,000
Total		166,740
Add amount used by this company in and about its plant, substantially		1,000
Total		167,740

* Renewal. † Letter confirming use under contract.

Of the above amount of power subject to call under executed contracts about 102,550 horse-power already has been called and now is in use. A statement in detail of the amount of power now used by each of the above companies is given on pages 4 and 5 of this company's printed statement, dated July 3, 1906, and filed with the Secretary of War on or about the 11th day of July, 1906.

The above amounts of power subject to call under the aforesaid contracts and the amounts of power now in use, set forth in the said statement, are amounts deliverable or delivered at the plants of the respective tenants. If the maximum demands of all tenants should occur simultaneously, it would be necessary to add thereto an average of at least 5 per cent in order to compute the amount of power which must be generated in the plants of the Niagara Falls Power Company or transmitted from Canada to make such delivery.

(6) *Charters.*

The Niagara Falls Power Company was incorporated and derives its corporate rights and powers under the terms of enactments of the legislature of the State of New York, to wit, chapter 83 of the laws of 1886, as amended or enlarged by (1) chapter 489 of the laws of 1886; (2) chapter 109 of the laws of 1889; (3) chapter 253 of the laws of 1891; (4) chapter 513 of the laws of 1892; (5) chapter 477 of the laws of 1893. A printed copy of the charter will be found in the aforesaid statement heretofore made to the Secretary of War, pages 13 to 26, inclusive.

(7) *Statutory Powers.*

See the charter of the company, pages 13 to 26, of said statement to the Secretary of War.

(8) *Extent of Horse-power which under Charter or Statutory Power Company may produce.*

The company as ripariau owner of about 2½ miles of the American shore of the Niagara River and as owner by purchase from the State of New York of all of the adjacent lands under water, with the coucession or consent of all other interested riparian owners already obtained, is entitled to divert the water of the Niagara River for the purpose of the production of power to any extent not interfering with the practical navigation of the stream.

By the express terms of its charter, constituting a contract, the Niagara Falls Power Company is authorized and empowered by the State of New York to take and use the waters of the Niagara River at any points on or opposite to any riparian land owned by the company to the extent required for the proper operation of its authorized works during the continuance of such works, provided that nothing contained in the Acts of the legislature concerning the Niagara Falls Power Company shall be so construed as to authorize it to take from the Niagara River more water than shall be sufficient to produce 200,000 effective horse-power.

(9) *The Amount of Actual Construction completed.*

The Niagara Falls Power Company has completed the construction of (1) its plant No. 1, containing 10 generating units of substantially 5,000 horse-power capacity each; (2) its plant No. 2, containing 11 generating units of substantially 5,500 horse-power capacity each; (3) four power-transmission lines to the city of North Touawanda, three of which extend to the city of Buffalo; (4) its tunnel No. 1, used as the tailrace for its power-houses Nos. 1 and 2 and for the said plants of the International Paper Company and of the Niagara Falls Water Works Company; (5) its inlet canal from the Niagara River, designed for a power development additional to that of power-houses Nos. 1 and 2; (6) its various step-up and other transforming stations; (7) other accessory and appurtenant apparatus and parts.

In addition thereto, the International Paper Company, a tenant company, upon the riparian lands above referred to, under rights granted by lease by the Niagara Falls Power Company, has constructed a plant for the production of substantially 8,600 horse-power in the form of hydraulic power. The water for the operation of this plant is diverted from the inlet canal of the Niagara Falls Power Company and is discharged into the latter company's tailrace tunnel

(10) *The amount of Money invested in partially completed Plants.*

The Niagara Falls Power Company, in pursuance of its original plan for the construction of plants on its lands for the development of 200,000 horse-power, has invested moneys to a large amount, in addition to that actually required for its first development, which amount, however, is not kept separate on its books of account from the amount properly applicable to the completed plants. The plan of the company did not contemplate a division of its total 200,000 horse-power construction, and therefore there was no reason separately to state the amounts properly applicable to its various plants constructed or to be constructed for the development of 200,000 effective horse-power. (See printed statement to Secretary of War, Clause X, correcting a typographical error in the first line where the intended date 1890 is printed "1900.")

(11) *The amount of Money necessary to complete Plants.*

It is estimated that substantially $7,000,000 more will be required to complete the entire plant of the Niagara Falls Power Company for the production on its lands at Niagara Falls, N.Y., of 200,000 effective horse-power and distribution of same to points of power use. In other words, for about $7,000,000 the company can approximately double its present output, for which thus far it has expended $15,419,974.92. The profit upon the undertaking lies principally in this second and uncompleted tunnel. Though at work since 1889, the company has not yet declared or paid any dividend.

(12) *The amount of Electrical Current now being furnished.*

Substantially 94,000 electrical horse-power, to which must be added substantially 8,500 horse-power in the form of hydraulic power. (For details see pp. 4 and 5 of the said statement to the Secretary of War.)

(13) *The amount of Power which can be reasonably furnished with the Plant under construction.*

The present plants are now being operated substantially to full capacity, and already are supplemented at times by substantially 16,000 horse-power transmitted from the plant of the Canadian Niagara Power Company in the Dominion of Canada.

(14) *The amount of Power that can be sold in the existing Markets.*

In addition to 166,670 horse-power now subject to call under contracts already executed, the details of which are given above in reply to question 5, there are now in various states of negotiation contracts under consideration under the terms of which, if consummated, an additional amount of power aggregating at least 75,000 horse-power will become subject to call.

The market for electrical power at Niagara Falls, N.Y., has constantly increased and is now increasing. Since the first delivery of power by this company in 1895, there has been no time when this company has not had under consideration bona fide applications for power. Many of these applications involving requirements, in single instances for 10,000 horse-power and upward, from time to time the company has been obliged to refuse, in some cases on account of terms demanded and in others because it could not have power available in the quantities and within the time required. Since the company's

first delivery of power it has negotiated and executed contracts every year calling for the delivery of considerable additional amounts of power.

The use of power by the present power tenants located on the manufacturing lands of this company has steadily increased from the time of the first construction of their respective plants. In some cases such use within the past eight years has quadrupled and is still increasing.

The management of the company has believed and now has every reason to continue its belief that the market for power for delivery at Niagara Falls, N.Y., and in the city of Buffalo, N.Y., is such that before the works embraced in the company's entire plan can be fully completed, this company will easily be able to and will sell the entire output of its American plants for 200,000 horse-power, and in addition thereto at least 121,000 horse-power from the Canadian Niagara Power Company. It is to be understood that the said amount of 121,000 horse-power represents substantially one-half the expected aggregate output of the Canadian company's original plans for power development in the Queen Victoria Niagara Falls Park, and which, as soon as there is an adequate market in Canada for the power, it expects to complete.

(15) *All other circumstances tending to reflect on the effect which a Limitation by a Permit will have on the Company's Business.*

Herewith is submitted a copy of the company's balance sheet (a) in full detail, at June 30,1906, and a comparative income account (a) for the month and for the six months ended June 30, 1906, and 1905. A refusal of the permits sought would render substantially valueless the assets of this company, which it will be observed by its income statement is earning in full the fixed charges on all its funded debt chargeable to the development on the American side, to wit: On $13,000,000, and in addition a surplus applicable to dividends on $4,100,700, its issued capital stock, at the rate of over 9 per cent per annum, though as before observed no dividend has ever been paid.

The fact that in addition to its $4,180,700 capital stock, the Niagara Falls Power Company has already issued its funded obligations to the amount of substantially $18,000,000, and has already authorized an additional issue of $3,000,000, more than $300,000 of which has already been advanced by it and additional expenditures already incurred by the Canadian company for the completion of the parts of its said plant No. 1, named in reply to 2 of its statement (a) to Captain Kutz of even date herewith, which expenditures will be met by the American company, all for the purpose of securing an output of power on the American and Canadian sides of the Niagara River sufficient to enable it to fill contracts for power in the United States which it has entered into or has under negotiation, and that this action was taken in pursuance of a well-defined and comprehensive plan made by it fifteen years ago on the faith of its common-law rights as a riparian owner and of the statutes of the State of New York and Province of Ontario, the owners of the bed of the Niagara River, should be sufficient warrant for the absolute good faith of that company, and the great damage that would be caused by a refusal by the Secretary of War of the permit recently authorized by the Congress and applied for by this company. In connection therewith should be considered the damage that would be suffered by the public who, in good faith, became investors in and now are the holders of $18,000,000 of bonds or debentures made or guaranteed by the Niagara Falls Power Company.

The Niagara Junction Railway Company (substantially all the capital stock of which is owned by the Niagara Falls Power Company) has an invest-

* Not printed.

ment in its road and equipment of substantially $500,000. The Niagara Development Company (substantially all the capital stock of which is owned by the Niagara Falls Power Company) has an investment in its residence property and lands in the city of Niagara Falls, N.Y., of approximately $1,285,000. The Tonawanda Power Company (more than two-thirds of the capital stock of which is owned by the Niagara Falls Power Company) has an investment in plant and distributing system and other property of substantially $460,000. The Cataract Power and Conduit Company (more than one-half the capital stock of which is owned by the Niagara Falls Power Company) has an investment in plant and distributing system and other property in the city of Buffalo, N.Y., of substantially $3,000,000. The power tenants of the Niagara Falls Power Company have an investment of upward of $7,000,000 in plants and other property, mostly on the lands of the Niagara Falls Power Company. The refusal of the Secretary of War to grant the permit now asked for would affect disastrously and destructively all of the investments referred to in this paragraph.

The company desires to call attention to the fact that, at a cost to itself of several hundred thousands of dollars, from the beginning it has spared no expense to prevent any marring of the natural beauty of the great cataract or its surroundings.

Attention is also called to the facts stated at length in the said statement of this company filed with Secretary of War on or about July 11, 1906.

The above information is submitted by the Niagara Falls Power Company, which, however, respectfully protests against the provisions of the Act of the Congress approved June 29, 1906, 'For the control and regulation of the waters of Niagara River, for the preservation of Niagara Falls, and for other purposes,' in so far as such provisions prohibit or are inconsistent with the present and continued exercise by the Niagara Falls Power Company or its just and lawful right during the continuance of its works, to divert the waters of the Niagara River and to use the same for the creation of power to an extent sufficient to produce 200,000 effective horse-power, and without waiving, it respectfully reserves the applicant's said right and all right now vested in it or to which it is now entitled (1) under the common law, or (2) under the statutes of the State of New York.

Dated at Niagara Falls, N.Y., this 27th day of July, 1906.

THE NIAGARA FALLS POWER COMPANY,
BY PHILIP P. BARTON, *General Manager*

Capt. CHARLES W. KUTZ,
Corps of Engineers, U.S. Army.

APPENDIX J.

STATEMENT OF THE NIAGARA FALLS HYDRAULIC POWER AND MANUFACTURING COMPANY.

THE NIAGARA FALLS HYDRAULIC POWER
AND MANUFACTURING COMPANY,

NIAGARA FALLS, N.Y., July 28, 1906.

DEAR SIR:—Replying to your favour of July 24, relative to the proposed investigation of the operations of this company, in which you asked for specific reply in writing to the several points of information asked for in the communication of the Secretary of War, dated July 14, 1906, we beg to submit the following:

SESSIONAL PAPER No. 19a

1. The capital which has been invested in all the power plants? The investment represented by the plant of the Niagara Falls Hydraulic Power and Manufacturing Company is $5,644,802.43.

2. The extent to which these plants are in actual use? This company actually uses 39,868 horse-power.

3. The amount of cubic feet of water actually in use? Four thousand and three cubic feet per second.

4. The amount of electrical power actually generated? About 28,800 horse-power.

5. The contracts made by these companies for the furnishing of power?

6. The date when the contracts were made?

The following is a list of the customers of this company, and gives the amounts of their contracts, and the dates upon which they were made:

Name of customers.	Date of contract.	Electrical horse-power.	Mechanical horse-power.
Cliff Paper Co	May 3, 1892		2,600
Niagara Falls Milling Co.—			
Niagara mill	May 1, 1900		900
Central mill	"		1,000
Niagara Wood Paper Co	January 1, 1880		250
City waterworks, for power	September 1, 1878		1,000
Cataract City Milling Co	August 1, 1878		440
Pettebone-Cataract Paper Co	August 1, 1878		1,525
" "	December 27, 1904		276
Total			7,991
Furnished from station No. 2.			
Pittsburgh Reduction Co	August 2, 1895	17,980	17,980
	February 2, 1899		
	December 27, 1899		
National Electrolytic Co	August 1, 1904		3,920
	Renewing leases—		
	September 13, 1897		
	April 1, 1899		
	November 30, 1898		
Acker Process Co	June 14, 1899		4,630
Buffalo and Niagara Falls Electric Light and Power Co	March 4, 1898		1,250
Oneida Community (Limited)	September 9, 1880	300	
New York State Reservation	May 2, 1896	20	
New York Central and Hudson River R. R. Co	March 30, 1901	15	
Niagara Waterproofing Co	November 1, 1902	10	
Gassler's Niagara Falls Bakery	Previous to January 1, 1904	4	
Cataract-Journal Co	" "	8	
Upper & Upper	" "	3	
C. E. Allen	" "	20	
Gazette Publishing Co	" "	27	
Gluck Realty Co	" "	7	
Max Amberg	" "	3	
Niagara Falls post-office	" "	1	
Butler Grocery Co	" "	1	
W. E. Bateman	" "	1	
Dr. W. R. Campbell	" "	1	
Philpott & Leuppie	" "	5	
Cataract Machine and Auto Co	" "	2	
H. R. Converse	" "	2	
F. W. Oliver Co	" "	13	
Miller & Brundage	" "	8·5	
J. V. Banks	" "	1	
Cataract Haircloth Co	" "	59	
Suspension Bridge Bottling Works	" "	1	
E. J. Hahn	" "	2	
Wicker Lumber Co	" "	35	
Niagara Falls Brewing Co	" "	123	

Name of customers.	Date of contract.	Electrical horse-power.	Mechanical horse-power.
Brown Printing Co.	Previous to January 1, 1904	2	
McGarigle Machine Co.	" "	11	
Niagara Falls Haircloth Co.	" "	40	
Carl Steinbrenner	" "	30	
R. G. Hardy	" "	1	
Bell Telephone Co.	" "	2	
Forty-second Separate Co.	" "	1	
Phillip Keller	May 1, 1904	10	
A. Hartman	Previous to January 1, 1904	6	
J. A. Weber	" "	1	
Niagara River Elevator Co	" "	5	
Niagara Foundry Co.	" "	8	
F. E. Dean Co.	" "	20	
Central Machine Co.	" "	5	
Crick Bros.	" "	19	
Cataract Stamping Co.	September 1, 1904	1	
Frontier Coal and Ice Co.	September 23, 1905	4	
Niagara Pattern Works	January 1, 1906	3	
True Artificial Limb Co.	November 1, 1905	1	
Carter-Crume Co. (Limited)	August 1, 1902	125	
Palace Laundry Co.	August 1, 1904	27	
Cataract Ice Co.	December 1, 1903	75	
Wm. A. Rogers (Limited)	January 1, 1904	508	
Niagara Gorge R. R.	May 1, 1897	1,000	
Niagara Falls Ice Manufacturing and Storage Co.	July 1, 1906	50	
Cliff Paper Co.	No contract	67	
Niagara Falls Hydraulic Power and Manufacturing Co.	Own use	625	
			4,097
For station No. 2			31,877
Total horse-power			39,868

7. The charter of the company and the statutory powers? We give below copy of the charter of this company as a corporation, and the copy of the Act of the legislature of the State of New York confirming our rights:—

LICENSE.

STATE OF NEW YORK,

Office of the Secretary of State, ss:

Whereas an application for the formation of a corporation in the class of full liability, under the corporate name of 'The Niagara Falls Hydraulic Power and Manufacturing Company' pursuant to the provisions of chapter 611, laws of 1875, entitled 'An act to provide for the organization and regulation of certain business corporations,' was filed in this office on the twenty-third day of April, A.D. 1878.

I therefore license and appoint Abram M. Chesborough, Jacob F. Schoellkopf, Horace Stillman, Louis Schoellkopf, and James Frazer Gluck, commissioners, to open books for subscriptions to the capital stock of such corporation, agreably to the requirements of the said Act.

Witness my hand and seal of office of the Secretary of State at the city of Albany, this twenty-third day of April, 1878.

GEO. MOSS,

[SEAL.] Deputy Secretary of State.

The legislature of the State of New York in 1896 passed an Act known as chapter 968 of the laws of 1896, which reads as follows:

'The people of the State of New York, represented in Senate and Assembly do enact as follows:—

'Section 1. The right of the Niagara Falls Hydraulic Power and Manufacturing Company to take, draw, use, and lease and sell to others to use, the waters of Niagara River for domestic, municipal, manufacturing, fire, and sanitary purposes, and to develop power therefrom for its own use and to lease and sell to others to use for manufacturing, heating, lighting, and other business purposes is hereby recognized, declared, and confirmed, and the exercise thereof by said company, its successors and assigns, to take and draw water from Niagara River for use and disposal to others to use for the purposes above specified, and for the development of power for use and for disposal to others to use, for purposes above mentioned, is hereby limited and restricted to such quantity of water as may be drawn by means of the hydraulic canal of said company when enlarged through its entire length to a width of 100 feet and to a depth and slope sufficient to carry at all times a maximum depth of fourteen feet of water, provided that exercise by said company of the rights hereby declared and confirmed shall not impair the practical navigation of Niagara River,'

8. The extent of horse-power which under their charters or statutory powers they might produce? One hundred and thirty-seven thousand nine hundred and ninety-one horse-power.

9. The amount of actual construction completed? Excluding work done on canal proper, $1,836,407.44.

10. The amount of money invested in partially completed plants? The investment of this company in partially completed plants, including outstanding contracts, is $2,013,772.68.

11. The amount necessary to complete them? One million four hundred and forty-eight thousand nine hundred and forty-five dollars.

12. The amount of electrical current now being furnished? The electrical current furnished by this company represents 12,500 horse-power. The remainder of the power furnished by this company is in the form of mechanical power and amounts to 37,368 horse-power.

13. The amount that can be reasonably furnished with the plant under construction? One hundred and thirty-seven thousand nine hundred and ninety-one horse-power.

14. The amount that can be sold in the existing markets by these companies? This company can sell all it can produce—137,991 horse-power.

15. All other circumstances tending to reflect on the effect which a limitation by a permit will have upon their business? The Niagara Falls Hydraulic Power and Manufacturing Company's plant dates from 1846, when surveys were made and plans published preliminary to its construction. A contract for its construction was entered into in December, 1892. Work upon its construction was begun in 1893. It was first made of a width of 30 feet and a depth of from 7 to 10 feet, the excavation being principally through solid rock, involving large expense. Up to 1877 only one mill had been erected for use of power generated from water flowing in this canal. The cost of the property up to this time is estimated at $750,000. In October, 1877, the canal and 75 acres of land for mill sites were conveyed to Jacob F. Schoellkopf and Abram M. Chesborough. The interest of Chesborough was soon acquired by Jacob M. Schoellkopf, who at once began the work of developing the canal and water-power. The firm of Schoellkopf & Mathews erected a large flouring mill, at a cost of several hundred thousand dollars, having a capacity of 1,500 barrels a day. Mr. Schoellkopf also induced the Oneida Community to erect a plant on the property and take a lease of power for ninety-nine years. In

1879 the Niagara Falls Hydraulic Power and Manufacturing Company was organized, with a paid in capital of $500,000, to which the canal and other property pertaining to it was conveyed, and this company has since continued the development of the property and enlargement of the canal, first making it 70 feet in width and increasing its depth and has recently enlarged it to its full width of 100 feet, practically, throughout its entire length. The work of widening will be completed within a few months.

In 1896 the State of New York, by legislative enactment, confirmed the riparian rights of this company to take water from the Niagara River for power purposes, limiting it, however, to such quantity as could be drawn through its canal when widened to its full width of 100 feet and made of such depth and slope as to carry at all times a uniform maximum depth of 14 feet of water, which the engineers compute to be equal to 9,500 cubic feet per second.

Since 1879 this company, relying on its common-law rights, as confirmed by statute of the State of New York, has expended in and about the purchase and improvement of this canal and appurtenances and property the total amount of its capital stock of $500,000, all of its earnings in excess of operating espenses, amounting to $1,216,577.66, to July 1, 1906, and in addition thereto the sum of $1,285,901.48 realized from the sale of its bonds.

Mr. Schoellkopf, for a period of about twenty years, devoted his best energies and business sagacity, in connection with his partners and associates, to the improvement and development of this property and died without having received one penny in return for his expenditure of money, time, and energy in the care and management of it. No dividends were paid until 1889, when 1 per cent on the capital stock was paid, and again in 1890, 1 per cent was paid. In 1892 the company began and has since continued the payment of dividend at the rate of 6 per cent per annum.

The stock of the company is largely held by trustees, under Mr. Schoellkopf's will, for the benefit of his children.

For a period of nearly thirty years the men associated in this company have paid in their money and given valuable time, attention, and care to the management of its affairs in the expectation of enjoying in the future the fruits of their labours and expenditure in and about a business which the legislature of New York has declared to be lawful and which the courts of the State had adjudged to belong to them.

They had expended great sums of money, aggregating millions, in improving this property in the expectation, born of adjudged ownership and legislative declaration of lawful right, of making use of 9,500 cubic feet of water per second. To this end they widened the canal to 100 feet and increased its depth and built bridges and power houses and installed machinery and entered into contracts, one for ninety-nine years, one for sixty years, and others for other long periods. If they are to be limited to 4,000 cubic feet of water per second, if their right to use even this amount is limited to the uncertain term of a revocable permit by the Secretary of War, be he ever so just, then this property, acquired and improved at such great cost of capital, time, care, and energy, will be practically confiscated. Money, amounting to millions, already expended in good faith, will have been wasted unless this company can be allowed to take water to the full capacity of its canal.

Manufacturers who have erected plants and made large investments in the material expectation of enlarging and extending their business will be crippled and prevented from material growth. What person or company would care to establish a business of any kind in the face of a constant menace that he might at any moment, at the will of a single officer, be prohibited from its continuance? The operation of this act will simply blight and destroy the manufacturing enterprise which has done so much in the last twenty years

not only for western New York, but for the whole country. It will not be possible to state 'all circumstances tending to reflect on the effect which a limitation by a permit will have upon our business,' but we have called attention to a sufficient number to show the damning and paralysing effect of the recent legislation.

16. Showing investment of largest plants supplied with power by this company:—

Niagara Falls Brewing Company	$400,000 00
Wm. A. Rogers (Limited)	700,000 00
Niagara Gorge Railroad Company	2,019,207 94
National Electrolytic Company	1,220,000 00
Acker Process Company	719,000 00
Oneida Community (Limited)	575,000 00
Carter-Crume Company (Limited)	2,000,000 00
Central Machine Company	30,000 00
Cataract Ice Company	70,000 00
Pittsburgh Reduction Company	1,750,000 00
Buffalo and Niagara Falls Electric Light and Power Company	700,000 00
	8,183,207 94

THE NIAGARA FALLS HYDRAULIC POWER AND MANUFACTURING COMPANY,

CAPT. CHARLES W. KUTZ, Corps of Engineers, U.S. Army.

By A. SCHOELLKOFF, Secretary and Treasurer.

No. 1.

Real estate—		
Residence land	$ 23,337 52	
Canal land and improvements	230,265 57	
Land at north end of city	84,679 22	
		$ 338,282 31
Canal way		723,428 31
Power-houses and other buildings and transmission lines completed (details shown in No. 9)		1,615,604 44
Power-houses under construction—		
Paid	$303,373 12	
Work contracted for	393,311 25	
		696,684 37
Cost of Pittsburgh Reduction Company's generators in station No. 2		220,803 00
		$3,594,802 43
Money invested in canal previous to this company's ownership		750,000 00
Interest on $1,000,000 average investment for twenty-six years		1,300,000 00
		$5,644,802 43

2. The extent to which these plants are in actual use? Reply, 39,868 horse-power, made up as follows.—

	Horse-power.	Horse-power.
Water—		
Cliff Paper Company	2,600	
Niagara Falls Milling Company—		
Niagara mill	900	
Central mill	1,000	
Niagara Wood Paper Company	250	
City waterworks, for power	1,000	
Cataract City Milling Company	440	
Pettebone-Cataract Paper Company	1,801	
Total water		7,991
Electricity (station No. 2)—		
Gassler's Niagara Falls Bakery	4	
Cataract-Journal Company	8	
Upper & Upper	3	
C. E. Allen	20	
Gazette Publishing Company	27	
Gluck Realty Company	7	
Max Amberg	3	
New York State reservation	20	
Niagara Falls post-office	1	
Butler Grocery Company	1	
W. E. Bateman	1	
Niagara Waterproofing Company	10	
Dr. W. R. Campbell	1	
Philpott & Leuppie	5	
Cataract Machine and Auto Company	2	
H. R. Converse	1	
True Artificial Limb Company	1	
F. W. Oliver Co	13	
Miller & Brungade	8½	
Jas. V. Banks	1	
Cataract Haircloth Company	59	
Suspension Bridge Bottling Works	1	
E. J. Halm	2	
Wicker Lumber Company	35	
Niagara Falls Brewing Company	123	
Brown Printing Company	2	
McGarigle Machine Company	11	
Niagara Falls Haircloth Company	40	
Carl Steinbrenner	30	
R. G. Hardy	1	
Bell Telephone Company	2	
Forty-second Separate Company	1	
Phillip J. Keller	10	
A. Hartman	6	
J. A. Weber	1	
Niagara River Elevator Company	5	
Cataract Stamping Company	1	
New York Central and Hudson River Railroad Co	15	
Niagara Foundry Company	8	

	Horse-power.	Horse-power.
Frontier Coal and Ice Company	4	
Niagara Pattern Works	3	
F. E. Dean Company	20	
Carter-Crume Company (Limited)	125	
Central Machine Company	5	
Palace Laundry Company	27	
Cataract Ice Company	75	
Crick Brothers	19	
Wm. A. Rogers (Limited)	508	
Oneida Community (Limited)	300	
Niagara Gorge Railroad Company	1,000	
Cliff Paper Company	67	
Niagara Falls Ice Manufacturing and Storage Company	50	
Niagara Falls Hydraulic Power and Manufacturing Company	625	
Total electricity		4,097
Pittsburg Reduction Company		17,980
National Electrolytic Company		3,920
Acker Process Company		4,630
Buffalo and Niagara Falls Electric Light and Power Company		1,250
Total horse-power		39,868

3. The amount of cubic feet of water actually in use? Reply, 4,003 cubic feet per second.

Water:	Horse-power.
Cliff Paper Company	2,600
Niagara Falls Milling Company:	
Niagara mill	900
Central mill	1,000
Niagara Wood Paper Company	250
City waterworks, for power	1,000
Cataract City Milling Company	440
Pettebone-Cataract Paper Company	1,801
Total water	*7,991

Electricity (station No. 2):	
Gassler's Niagara Falls Bakery	4
Cataract-Journal Company	8
Upper & Upper	3
C. E. Allen	20
Gazette Publishing Company	27
Gluck Realty Company	7
Max Amberg	3
New York State Reservation	20
Niagara Falls post-office	1
Butler Grocery Company	1
W. E. Bateman	1
Niagara Waterproofing Company	10
Dr. W. R. Campbell	1
Philpot & Leuppie	5

* Equals 1,332 cubic feet per second.

Electricity (station No. 2)—Continued.	Horse-power.	Horse-power.
Cataract Machine and Auto Company	2	
H. R. Converse	1	
True Artificial Limb Company	1	
F. W. Oliver Company	13	
Miller & Brundage	8½	
Jas. V. Banks	1	
Cataract Haircloth Company	59	
Suspension Bridge Bottling Works	1	
E. J. Hahn	2	
Wicker Lumber Company	35	
Niagara Falls Brewing Company	123	
Brown Printing Company	2	
McGarigle Machine Company	11	
Niagara Falls Haircloth Company	40	
Carl Steinbrenner	30	
R. G. Hardy	1	
Bell Telephone Company	2	
Forty-second Separate Company	1	
Phillip J. Keller	10	
A. Hartman	6	
J. A. Weber	1	
Niagara Falls Elevator Company	5	
Cataract Stamping Company	1	
New York Central and Hudson River Railroad Company	15	
Niagara Foundry Company	8	
Frontier Coal and Ice Company	4	
Niagara Pattern Works	3	
F. E. Dean Company	20	
Carter-Crume Company (Limited)	125	
Central Machine Company	5	
Palace Laundry Company	27	
Cataract Ice Company	75	
Crick Brothers	19	
Wm. A. Rogers (Limited)	508	
Oneida Community (Limited)	300	
Niagara Gorge Railroad Company	1,000	
Cliff Paper Company	67	
Niagara Falls Ice Manufacturing and Storage Company	50	
Niagara Falls Hydraulic Power and Manufacturing Company	625	
		4,097
Pittsburg Reduction Company		17,980
National Electrolytic Company		3,920
Acker Process Company		4,630
Buffalo and Niagara Falls Electric Light and Power Company		1,250
Total for station No. 2		*31,877

Total cubic feet per second now used, including 660 for sluicing debris and ice, 4,003.

4. The output of station No. 2 is 31,877 horse-power of mechanical power, which at an efficiency of 90 per cent of the generators equals 28,800 horse-power,

* Equals 2,011 cubic feet per second.

while the installed capacity of station No. 2 in electrical generators is 32,027 horse-power. The power report on June 30 from station No. 2 shows 27,656 electrical horse-power developed. This, however, was about 1,000 less than our largest output to date.

8. The capacity of canal, when enlarged to 100 feet in width and 14 feet in depth, is estimated at 9,500 cubic feet per second, and deducting the 1,332 cubic feet per second used by the mills, which represents 7,991 horse-power, there would still be left 8,168 cubic feet, which would represent approximately 130,000 horse-power, which represents the present capacity of station No. 2, or 31,877 horse-power, and the proposed working capacity of station No. 3, now under construction, which in round numbers is 100,000 horse-power.

No. 9.

Transmission lines		$ 146,814 29
Power station No. 2	$ 674,898 69	
Amount paid on contracts	111,038 48	
Amount unpaid on contracts	10,794 00	
		796,731 17
Water-wheel plant, station No. 1, and gatehouse, No. 2		13,423 70
Office building		8,635 28
Niagara and central mills		650,000 00
		$ 1,615,604 44
Pittsburg Reduction Company's generators in station No. 2		220,803 00
		$ 1,836,407 44

No. 10.

Canal way		723,428 31
Power house No. 3:		
Money expended	$ 303,373 12	
Money on contracts let	393,311 25	
		696,684 37
Pittsburg Reduction Company's plant:		
Ten 3,540-kilowatt generators bought	$ 233,660 00	
Buildings bought	360,000 00	
		593,660 00
		$ 2,013,772 68

11. Estimate of completion of plant, July 28, 1906:—

Station No. 3:	
Concrete above, 8,000 yards, at $6	$ 48,000
Erection of steel work in forebay wall	10,000
Gate house floor system	13,500
Gate house steel superstructure	31,500
Gate house concrete sides, roof, etc	16,000
Gate house cranes	10,000
Penstocks steel	64,000
Reinforcing steel for penstocks	16,500
Concrete on penstocks and bank	90,000
Wire towers	18,500
Elevator tower	15,700
Elevator cages and machinery	14,500
Excavation below bank, 105,000 cubic yards rock, at $2	210,000

Two station cranes	$ 18,500
Station steel frame	140,500
Concrete, station No. 3	180,000
Seven water wheels, at $30,000	210,000
Two exciter wheels, at $5,000	10,000
Thirteen governors, at $2,000	26,000
Oiling systems, ventilating systems, etc	50,000
Contingencies	120,000
Total, station No. 3	1,313,200
For completion of canal system	135,745
	1,448,945

12. Twelve thousand five hundred horse-power represents the output of the electrical horse-power from station No. 2, exclusive of the Pittsburgh Reduction Company. The difference between this amount and 39,868, the total output of all plants at this time, represents 27,368 horse-power, which is developed but not delivered in the form of electrical power.

No. 13.

Niagara Falls Brewing Company	$ 400,000 00
Wm. A. Rogers (Limited)	700,000 00
Niagara Gorge Railroad Company	2,019,207 94
National Electrolytic Company	1,220,000 00
Acker Process Company	719,000 00
Oneida Community (Limited)	575,000 00
Carter-Crume Company (Limited)	2,000,000 00
Central Machine Company	30,000 00
Cataract Ice Company	70,000 00
Pittsburgh Reduction Company	1,750,000 00
Buffalo and Niagara Falls Electric Light and Power Company	700,000 00
	8,183,207 94

Appendix K.

DESCRIPTION OF THE POWER PLANT OF THE NIAGARA FALLS POWER COMPANY, BY EARL WHEELER, ELECTRICAL ENGINEER.

The Niagara Falls Power Company's stations, which are situated about 1 mile above the Falls, on the American side, take the water from the river by means of an intake canal, whose direction is at an angle somewhat less than 90° with the upstream side. From this canal the water is led to two separate power houses, one on each side of the canal, through vertical steel penstocks to vertical turbines, from which the water discharges into the open tailrace at the bottom of the wheel pit, from which the water is taken by a discharge tunnel to the river below the Falls, at a point under the Upper Steel Arch Bridge.

The Headworks.

The intake canal, which is 1,250 feet long, varies in width from 250 feet at its mouth to 100 feet at its extreme end. From this intake canal there are constructed 21 inlets through submerged arch curtain walls to the inner forebay. The inner forebay, screens, and inlets are covered by an additional structure to the

main power houses, but adjacent to them on their canal sides. The racks are steel grillage set on inclined guides. Immediately in the rear of the racks are the bell mouths of the penstocks, which are 7½ feet in diameter each. There is installed at each penstock a vertical electrically operated gate.

The Wheel Pit, Power House No. 1.

Power house No. 1 has been erected upon the north side of the inlet canal. It has a wheel pit 427.7 feet in length, 18 feet in width, and an average depth of 178.5 feet below the power-house floor. The pit connects with the discharge tunnel, making an obtuse angle with the upstream side thereof. The turbines are mounted in this pit 37 feet from the bottom.

The Wheel Pit, Power House No. 2.

The wheel pit of this power house, which is located on the south side of the inlet canal, is 466 feet in length, 17½ feet in width, and had an average depth of 177.4 feet below the power-house floor. An extension of 675 feet connects the open tailrace tunnel of this power house to the main discharge tunnel.

Discharge Tunnel.

The discharge tunnel, which is 6,800 feet long from the wheel pit No. 1 to the lower river, is of the horseshoe-shaped cross section, 21 feet high and 18 feet 10 inches maximum width. It is lined throughout its entire length with several layers of vitrified brick laid in cement.

Power House No. 1.

The structure of this power house is of cut limestone, and is suitable for covering 11 units. The west end is made temporary, so that it can be extended. There are installed in this power-house 10 Fourneyon twin turbines, each of 5,000 horsepower, located 141½ feet below the power-house floor. The outside diameter of the runner is 6 feet 3 inches. It is estimated that these turbines, whichare without draft tubes, work under an effective head of 136 feet. They were designed by Faesch & Piccard, of Geneva, Switzerland, and built by the I. P. Morris Company, of Philadelphia. The generators are directly connected to the turbines by hollow vertical shafts 38 inches in diameter. Each generator has a nominal capacity of 3,750 kilowatts, and is wound to deliver 2,200 volts, 2-phase current, at 25 cycles. These generators are of the external revolving field type and revolve at 250 revolutions per minute. They were manufactured by the Westinghouse Electric and Manufacturing Company, of Pittsburg, Pa.

Switch Boards.

In this power house are installed two controlling switch boards, each of which controls and distributes the output of five generators. The main generator and feeder switches are pneumatically controlled.

Power House No. 2.

This structure is erected on the south side of the canal and is built of cut limestone. The east end is occupied by the general offices of the company. In this power house are installed eleven 5,500 horse-power turbines of the Francis single-runner, inward-flow type, with draft tubes. They were designed by Escher Weiss & Co., of Zurich, Switzerland, and built by the I. P. Morris Company, of Philadelphia. The effective head is 144 feet.

The Generators.

This station is equipped with eleven 3,750-kilowatt, 2,200-volt 2-phase alternators, giving current at 25 cycles. Six of these are of the external revolving field type, while the other five are of the internal revolving field type. The methods of driving and support are similar to those used in wheel pit No. 1. The entire electrical equipment was designed and built by the General Electric Company, of Schenectady.

Switch Board.

The switch-board installation of this plant is arranged so that from a single operating switch board, the entire output of the eleven machines is controlled and distributed. The switch-board installation was designed and built by the General Electric Company under specifications of the power company's engineers.

Transformer House.

The transformer station consists of 20 General Electric transformers, each having a capacity of 937 kilowatts, transforming 2,200-volt 2-phase current to 22,000 volts, 3-phase. There are also 6 Westinghouse, oil-insulated, water-cooled, step-up transformers, each having a capacity of 1,875 kilowatts, which are used to transform 2,200-volt 2-phase current to 22,000, 3-phase.

There are also 8 oil-insulated, water-cooled Westinghouse transformers which have a capacity of 1,875 kilowatts each, which are used to transform 2,200 to 11,000 volts, 3-phase, and are used to supply circuit to the most distant customers. These transformers have a total capacity of 15,000 kilowatts, and the entire output is delivered to the Union street substation. The total capacity of the installed transformers is 45,000 kilowatts, or 60,000 electrical horse-power.

The present transformer house was designed and has foundation complete to receive 12 more transformer units, each of 1,875 kilowatts capacity, making a total of 22,500 kilowatts. When these transformers are installed, this transformer plant will have a total capacity of 67,500 kilowatts, or 90,000 electrical horse-power.

The Union Street Substation.

Between the step-up transformer house and the Union street substation there are installed seven No. 000 lead-covered cables operating at a potential of 11,000 volts. The distance between the step-up transformer plant and the Union street substation is 10,700 feet. In the substation are at present installed eight 1,875 kilowatts, oil-insulated, water-cooled transformers, General Electric make, designed to transform from 11,000 volts, 3-phase, to 2,200 volts, 2-phase. This station has a transforming capacity at present of 15,000 kilowatts, or 20,000 horse-power.

The station was built with the intention of increasing its capacity. The north end is of a temporary structure. In the portion of the building which has been completed there are three additional transformers of the same capacity as those already installed. The building capacity is 20,625 kilowatts, or 27,500 horse-power.

Long-distance Transmission Line.

The long-distance service consists of two pole lines from the step-up transformer house to the terminal house in Buffalo, which is a distance of approximately 24 miles. On these two pole lines are installed two 3-phase copper conductor

transmission circuits each conductor having a cross section of 350,000 circular mils and one aluminum circuit which has a cross section of 500,000 circular mils, which is equivalent to the carrying capacity of each of the copper circuits. In addition to each of these lines to Buffalo there is installed another aluminum circuit supported on the same poles between the step-up transformer plant and the section house in North Tonawanda, which is about 15 miles, consisting of three aluminum conductors of 500,000 circular mils cross section each. Each of these lines has a nominal capacity of 10,000 horse-power.

The Terminal Station of the Cataract Power and Conduit Company in Buffalo.

In this terminal station are installed nine 2,250-kilowatt, oil-insulated, water-cooled transformers, arranged to transform from 22,000 volts, 3-phase, to 11,000 volts, 3-phase. There is also an additional spare transformer of the same capacity. The primaries on the transformers are connected directly to two sets of bus bars, and on the secondary, or 11,000-volt side of the step-down transformers, there are panels corresponding to the three groups of step-down transformers. These are connected directly to bus bars by selector switches. From the bus bars there are 10 feeders supplying through disconnecting switches on the circuit breakers, This terminal station is capable of having installed one more bank of 6,750 kilowatts capacity. The installed apparatus has a total capacity of 27,000 horse-power, while the building has a capacity of 36,000 horse-power.

The new terminal station of the Cataract Power and Conduit Company, which is being constructed, is designed for an ultimate capacity of 50,000 horse-power, but under the present plans there are to be installed apparatus that will aggregate 25,000 horse-power; that is to say, there are to be installed at the present time 6 transformers of 3,000 kilowatts each, which will transform from 22,000 volts, 3 phase, to 11,000 volts, 3 phase. The building is being constructed for the total capacity of 50,000 horse-power.

The current for this new substation is to be taken from the plant of the Canadian Niagara Power Company, which current is to be transmitted by way of Fort Erie, Canada, crossing the river at Fort Erie over long spans. The crossing towers, however, are being designed to support four 3-conductor circuits of 12,500 horse-power each. There are to be installed at present two of these circuits.

Appendix L.

DESCRIPTION OF THE POWER PLANT OF THE NIAGARA FALLS HYDRAULIC POWER AND MANUFACTURING COMPANY, BY EARL WHEELER, ELECTRICAL ENGINEER.

1. The general design of this company is for the development of power by canal. The water is carried by a canal (100 feet in width, except in a few places, an ultimate depth of 14 feet, and 4,400 feet long) to a hydraulic basin; thence by short intakes and vertical steel penstocks to power houses in the gorge for electrical power development and by short intakes and vertical penstocks to turbines located in shafts in the cliff for water tenants, the turbines operating under varying heads. The stations for electrical power development are designated as power houses Nos. 2 and 3.

Station No. 2.

2. This power-house is erected at the water's edge in the gorge, and is so designed that the water is used under a head of 200 feet. The power station is at present a structure 170 feet long by 100 feet wide. The construction is of stone and steel.

The Headworks.

3. From the main hydraulic basin there are two inlets which supply water to station No. 2. The first inlet is approximately even with the neck of the canal. From inlet No. 1 there is installed a vertical steel penstock 8 feet 6 inches in diameter, which penstock carries the water for the 4 turbines on the north end of the station. At the south end of the hydraulic basin is a second inlet for station No. 2. This inlet supplies water to No. 2 and No. 3 penstocks, each of which is 11 feet in diameter.

The Turbines.

4. The turbines, with the exception of Nos. 18 and 19, are all double-discharge horizontal Leffel turbines, with capacities ranging from 1,650 horse-power to 2,900 horse-power. Each turbine drives a generator of suitable capacity on each end of its shaft.

The Generators.

5. In this power-house there are now in operation 15 turbines connected to direct and alternating current machines. The ratings of the generators connected to the turbines by number are outlined below.

6. Turbines Nos. 4, 5, and 6, which are of 1,650 horse-power capacity at 250 revolutions per minute, each drive 2,560-kilowatt, 300-volt, direct-current Westinghouse generators.

7. Turbine No. 7 is of 1,900 horse-power capacity at 300 revolutions per minute, and drives 2,560-kilowatt, 550-volt, direct current General Electric generators. There is also belted to this turbine a 110 horse-power booster and a 200-kilowatt, 135-volt, direct-current generator. Both the booster and the generator were made by the General Electric Company.

8. Turbine No. 8 is of 2,800 horse-power, running at 257 revolutions per minute, and is connected to one 875 kilowatt, 175-violt, direct-current double-commutator General Electric generator and a 1,000-kilowatt, 11,000-volt, 3-phase Bullock alternator.

9. Turbine No. 9 is of 2,900 horse-power capacity, running at 250 revolutions per minute. It has directly connected on one end of its shaft one-875-kilowatt, 175-volt, direct-current, double-commutator General Electric generator and on the other end a 1,000-kilowatt, 325-volt, direct-current, double-commutator General Electric generator.

10. Turbine No. 10 is of 2,900 horse-power capacity, running at 250 revolutions per minute, and drives two 1,000-kilowatt, 325-volt, double-commutator General Electric generators.

11. Turbines Nos. 11 and 12 are each of 2,300-horse-power capacity, running at 250 revolutions per minute, and each is directly connected to two 750-kilowatt, 300 volt, direct-current Westinghouse generators.

12. Turbine No. 13 is of 2,900 horsepower capacity, running at 250 revolutions per minute, and has at one end of its shaft, directly connected, a 1,000-kilowatt, 11,000-volt, 3-phase Bullock alternator and on the other end, directly connected, a 700-kilowatt, 2,200-volt, single-phase Walker alternator. The

11,000-volt alternator, in connection with the 11,000-volt alternator on turbine No. 8, generates 3-phase current, which is transmitted by triplex, lead-covered cables to the transformer station located on the top of the cliff. In this station the voltage of a portion of the current is reduced to 2,200 volts for transmission and use in the vicinity. This buildiug also serves as a terminal station for the overhead transmission lines, carrying power at high voltage to the company's factory property at the north end of the city.

13. Turbines Nos. 14 and 15, each of which is 2,900 horse-power capacity, at 250 revolutions per minute, each operates two 1,000-kilowatt, 300-volt, Westinghouse generators.

14. Turbines Nos. 16 and 17 are of 2,300 horse-power capacity each, running at 250 revolutions per minute. Each has directly connected to it, two 750-kilowatt, 300-volt, direct-current Westinghouse generators.

15. Turbine No. 18 is a 250 horse-power horizontal wheel, made by J. M. Voith, of Heidenheim, Germany. It drives 150-kilowatt, 125-volt, direct-current generator, which supplies the exciting current for the 3-phase alternators. This set runs at 600 revolutions per minute.

16. Turbine No. 19 is of 550 horse-power capacity, running at 475 revolutions per minute, and drives a 400-kilowatt, 550-volt, direct-current generator.

Switch Board.

17. The switchboard for power-house No. 2 is about 100 feet long and is located on a gallery that runs along the cliff side of the station. It has 32 panels of Vermont marble on which are installed the operating instruments and switches for the complete installation. Switch board and station wiring are of fireproof construction and the board is so arranged that, although there are many different kinds of current generated in the station, a relay is provided for every generator and alternator in the station except the single-phase alternator.

Station No. 3.

18. Since the present development does not represent the full capacity of this company's canal, it has commenced the erection of an additional power-house of a nominal rating of 100,000 horse-power. This station will be situated at the water's edge in the gorge north of the present station. Its total length when completed will be 350 feet and its width 90 feet. The turbine and generator rooms are to be separated by a concrete wall extending the entire length of the station.

The Headworks.

19. The intake of this station has been excavated on the cliff at the north end of the hydraulic basin. At the south end of the extension is an ice sluiceway under construction leading to the river below through an inclined pen chute; also at the south end of this extension there is installed a cantilever construction from which will run an electric hoist for handling machinery from the railroad to the power house below.

20. The design for the intakes consists of steel gates and concrete bell mouths situated on the west side of the extension. There are to be in all 13 intakes. At the mouth of each intake is to be installed an electrically operated steel gate. From each intake there will be a vertical steel penstock 9 feet in diameter, leading to a turbine in the power-house below.

21. The extension of the hydraulic basin is being completed at the present time for the entire 11 units. The cantilever hoist construction and the ice sluiceway are completed. The excavation for the power-house at the water's edge is progressing for the entire development.

The Turbines.

22. The turbines are to be of 8,000 horse-power capacity, single horizontal runner, double-discharge, inward-draft tubes. Water will discharge out of the draft tubes into a bay beneath the generator room. On the river side of this bay is a weir whose crest is slightly higher than the top of the draft tubes. This construction will aid in holding the vacuum in the draft tubes. The turbines are situated in a room separate from the generators.

The Generators.

23. At present it is decided that for the first 4 units there are to be 2 direct-current, double-commutator generators for each turbine. These generators are to be furnished by the Pittsburgh Reduction Company, to whom the current will be supplied.

1907

THE CHICAGO DRAINAGE CANAL.

JOINT REPORT OF THE INTERNATIONAL WATERWAYS COMMISSION.

INTERNATIONAL WATERWAYS COMMISSION,

TORONTO, ONT., January 4, 1907.

The Honourable Secretary of War of the United States,

The Honourable Minister of Public Works of Canada:

The International Waterways Commission has the honour to submit the following report upon the Chicago Drainage Canal:

1. The headwaters of the Illinois River, an important tributary of the Mississippi, approach within 10 miles of Lake Michigan near its southerly end, where stands Chicago. The river, called here the Des Plaines, is separated from the lake by a low and narrow divide running nearly north and south. In the divide are two depressions, about 8 miles apart, in which the height is only about 10 feet above the surface of the lake. The area eastward of the divide is drained by two streams, the Chicago and the Calumet rivers, which empty into Lake Michigan.

The city of Chicago was originally built on the Chicago river, and, although it is now spreading into the Calumet region, it was for many years drained exclusively by the Chicago river, and its principal parts are now so drained. This river constitutes the main sewer of Chicago. The lake furnishes the city's water supply. To prevent the pollution of the water supply by sewage has always been the most important problem with which Chicago has had to deal. Its solution has from a very early day been found in diverting a part of the river's flow into the valley of the Des Plaines through the most northerly of the two depressions mentioned above. The Illinois and Michigan Canal, which was opened to navigation in 1848, was at once utilized for this purpose, and all subsequent improvements consisted in efforts to force more sewage through that canal until, in 1889, it was decided to build a new and greatly enlarged channel which should completely divert the Chicago river from Lake Michigan and draw from that lake a body of pure water large enough to make the sewage inoffensive to the communities by whose doors it must pass.

2. Before embarking upon this work the city in 1886 appointed a commission of three engineers 'to consider and report on any and all things which relate to the matter of water supply and drainage of the city of Chicago.' In January, 1887, the commission submitted a report to the mayor and city council of Chicago (copy appended marked A), which it styled a preliminary report. It intended to submit an additional or final report in which the data upon which its conclusions were based should be given in greater detail, but such additional report was never submitted. After remarking that 'almost every conceivable way of dealing with these questions had been suggested and in some form applied during the past thirty years,' the commission stated that 'among the possible methods of getting rid of the Chicago sewage there are but three that have been deemed worthy of consideration, namely, a discharge into Lake Michigan, a disposal upon land, and a discharge into the main river.' It considered the first method too expensive, involving as it does a wide separation between the outlets of the

sewers and the intakes of the water supply. It pronounced the second inapplicable to the metropolitan district as a whole, under the topographical conditions existing, but thought that it might be employed for the extreme northern and southern parts, the latter including the Calumet region. It recommended the third method. It was uncertain as to the quantity of water required to dilute the sewage so as to make it inoffensive, but in order to prepare an estimate of cost it was compelled to assume some approximate size of channel, and it did assume a size large enough to discharge 600,000 cubic feet per minute, that being the estimated amount of water falling upon the area tributary to the canal during storms and not otherwise disposed of. It includes the drainage basins of the upper Des Plaines and of the Chicago river, but not that of the Calumet river with a channel of less dimensions in times of storms and floods, the Chicago river would not be fully diverted into the Des Plaines, but would back up into Lake Michigan. The result was a supply of 24,000 cubic feet per minute for each 100,000 people in a population of 2,500,000, the population which the commission thought it desirable to provide for, and the opinion was expressed that this would equal the maximum requirements.

3. Following this report the Illinois legislature passed an Act approved May 29, 1889, 'to create a sanitary district and to remove obstructions in the Des Plaines and Illinois rivers,' of which the twenty-third and twenty-fourth paragraphs read as follows, viz:—

'Paragraph 23.—If any channel is constructed under the provisions hereof by means of which any of the waters of Lake Michigan shall be caused to pass into the Des Plaines or Illinois rivers, such channel shall be constructed of sufficient size and capacity to produce and maintain at all times a continuous flow of not less than 300,000 cubic feet of water per minute, and to be of a depth of not less than 14 feet, and a current not exceeding 3 miles per hour, and if any portion of any such channel shall be cut through a territory with a rocky stratum where such rocky stratum is above a grade sufficient to produce a depth of water from Lake Michigan of not less than 18 feet, such portion of said channel shall have double the flowing capacity above provided for, and a width of not less than 160 feet at the bottom capable of producing a depth of not less than 18 feet of water. If the population of the district draining into such channel shall at any time exceed 1,500,000, such channel shall be made and kept of such size and in such condition that it will produce and maintain at all times a continuous flow of not less than 20,000 cubic feet of water per minute for each 100,000 of the population of such district, at a current of not more than 3 miles per hour, and if at any time the general government shall improve the Des Plaines or Illinois rivers, so that the same shall be capable of receiving a flow of 600,000 cubic feet of water per minute, or more, from said channel, and shall provide for the payment of all damages which any extra flow above 300,000 cubic feet of water per minute from such channel may cause to private property so as to save harmless the said district from all liability therefrom, then such sanitary district shall, within one year thereafter, enlarge the entire channel leading into said Des Plaines or Illinois rivers from said district to a sufficient size and capacity to produce and maintain a continuous flow throughout the same of not less than 600,000 cubic feet of water per minute, with a current of not more than 3 miles per hour, and such channel shall be constructed upon such grade as to be capable of producing a depth of water of not less than 18 feet throughout said channel, and shall have a width of not less than 160 feet at the bottom. In case a channel is constructed in the Des Plaines river, as contemplated in this section, it shall be carried down the slope between Lockport and Joliet to the pool commonly known as the upper basin, of sufficient width and depth to carry off the water the channel shall bring down from above. The district constructing a channel to carry water from Lake Michigan of any amount authorized by this Act may correct, modify, and remove obstructions in the Des Plaines and Illinois rivers, wherever it shall be

necessary so to do to prevent overflow or damage along said river, and shall remove the dams at Henry and Copperas creek, in the Illinois river, before any water shall be turned into said channel. And the canal commissioners, if they shall find at any time that an additional supply of water has been added to either of said rivers by any drainage district or districts, to maintain a depth of not less than 6 feet from any dam owned by the State to and into the first lock of the Illinois and Michigan canal at La Salle, without the aid of any such dam, at low water water, then it shall be the duty of said canal commissioners to cause such dam or dams to be removed. This Act shall not be construed to authorize the injury or destruction of existing water-power rights.

'Paragraph 24. When such channel shall be completed, and the water turned therein, to the amount of 300,000 cubic feet of water per minute, the same is hereby declared a navigable stream, and whenever the general government shall improve the Des Plaines and Illinois rivers for navigation, to connect with this channel, said general government shall have full control over the same for navigation purposes, but not to interfere with its control for sanitary or drainage purposes.'

By this Act a flow of not less than 20,000 cubic feet per minute is required for each 100,000 inhabitants and provision is made for a population of 3,000,000. The evidence before the legislative committee which framed the Bill as to the quantity required was contradictory. The amount fixed for dilution of the sewage was a minimum. (See Appendix B.)

4. Under this Act the sanitary district of Chigago was organized, embracing all of the city north of Eighty-seventh street and some 43 square miles of Cook county outside of the city limits. The total area of the district was 185 square miles, and did not include the Calumet region nor the north shore. The trustees held their first meeting January 18, 1890. The Chicago Drainage Canal was then constructed, water being turned into it for the first time in January, 1900. It was not then, and has not since been completed to its full capacity as designed. In places where the excavation was in rock the full dimensions of the prism were taken out, but in earth a considerable volume was left to be removed by the easy method of dredging hereafter. When fully completed it was designed to have a capacity of 600,000 cubic feet per minute, or 10,000 cubic feet per second, flowing at a velocity of 1·25 miles per hour in earth and 1·9 miles per hour in rock.

5. The canal is 28·05 miles in length. For a distance of 7·8 miles from its junction with the Chicago river at Robey street its dimensions are 110 feet width at bottom, side slopes 1 on 2, depth of water 22 feet at low stage of Lake Michigan, with a grade of 1 in 40,000, the material being earth. This section is eventually to have a width of 200 feet at bottom.

6. For a farther distance of 5·3 miles, although the material is principally earth, the dimensions are 202 feet width at bottom, side slopes 1 on 2, minimum depth of water 22 feet, with a grade of 1 in 40,000. This section is completed.

7. For the remaining 15·95 miles the canal is excavated wholly or partially in rock. Where the natural rock does not come to the surface walls of masonry have been built upon the rock surface, thus artificially carrying it to a height 5 feet above datum. The dimensions here are 160 feet width at bottom, 162 feet width at top, minimum depth of water 22 feet, with a grade of 1 in 20,000. This section also is completed.

8. The controlling works are situated near the town of Lockport at the western end of the canal. They consist of a bear trap dam 160 feet wide, with a vertical play of 17 feet, and of seven sluice gates of the Stoney type, each 30 feet wide and having a vertical play of 20 feet. The works provide a very efficient means of controlling the flow of water through the canal.

9. The project of the sanitary district for the disposal of sewage by the canal when completed is briefly as follows: All sewers will discharge into the

Chicago river, either directly or through intercepting sewers. From the mouth in Lake Michigan to the point where the North and South branches unite the river will flow 8,000 cubic feet per second, less such quantity as may be pumped into the upper portion of the North branch, which under the original project was 200 cubic feet per second, admitted through a conduit at Fullerton avenue. From this point the combined flow will be 8,000 cubic feet to the point where the South fork enters the South branch, where it will be increased to 10,000 cubic feet by water pumped from Lake Michigan at Thirty-ninth street and flowing through a large conduit in Thirty-ninth street to the South fork. The volume which will finally enter the canal under this project will be 10,000 cubic feet per second.

10. The channel of the Chicago river is not large enough to transmit that volume from the lake to the canal except at velocities which are an obstruction to navigation. The amount which the Secretary of War has thus far permitted the sanitary district to pass through the river is 4,167 cubic feet per second. In order to obtain authority for a larger amount the trustees have undertaken to enlarge the channel of the river and have accomplished a large amount of work in that direction.

11. By Act of the Illinois legislature in 1903 the sanitary district was enlarged by annexing thereto the north shore district, containing 78·6 square miles, and the Calumet district, containing 94·48 square miles. The total area of the sanitary district is therefore now 358·08 square miles. The same legislature authorized the development of the water-power created by the diversion.

12. The plans for the north shore region involve two additional conduits from the lake to the North Branch of the Chicago river, one at Lawrence avenue, into which 583 cubic feet per second, and one at Wilmette, into which 1,000 cubic feet per second, are to be pumped. As this water is to form a part of the 10,000 cubic feet originally to be taken out through that river, it does not add to the amount of water to be taken from Lake Michigan.

13. The plans for the Calumet region involve a treatment of the Calumet river similar to that of the Chicago river. The river is to be diverted into the Des Plaines valley. For this purpose a new channel is to be cut through the southerly depression in the divide, and to join the present drainage canal at Sag, about 11 miles from the controlling works at Lockport. From Sag to Lockport the drainage canal must carry the flow from Calumet river in addition to that from the Chicago river. It was designed to accommodate the latter river alone, or 10,000 cubic feet per second, but improved methods of excavation, particularly channeling in rock, gave it a greater capacity than was computed; and the hydraulic formulæ with which its dimensions were figured, being adapted to smaller streams, gave results which proved to be too large. It is found that the portion completed in rock, which includes the reach from Sag to Lockport, will carry an amount stated by the Chief Engineer to be 14,000 cubic feet per second. The difference, 4,000 cubic feet per second, is the amount which it is proposed to divert from the Calumet river. For this purpose it is proposed to excavate a channel having in earth a bottom width of 72 feet, with side slopes 3 on 5, and in rock a bottom width of 90 feet vertical sides, the depth in both cases to be 25 feet.

14. Work in the territory annexed in 1903 has been limited to surveys and the preparation of plans, and the expenditures in that territory have been small. The amount expended upon the drainage canal and accessory works, including the above, to December 31, 1905, is $40,873,629.71; in addition to which $1,556,-226.56 has been expended for the development of water power and $7,290,101.27 has been paid out for interest. For a financial statement more in detail, see Appendix C.

15. Although the primary object of the Chicago Drainage Canal was the discharge of Chicago sewage, its function as a channel for navigation was kept in view from the beginning. All of the bridges over it are draw bridges with ample openings. A provision of this kind, as well as the care exercised to make the sewage inoffensive by liberal dilution, was necessary to conciliate the interests in the valley of the DesPlaines and Illinois rivers, which would otherwise be adversely affected. It can hardly be doubted that the canal will eventually form a part of an improved waterway between the Great Lakes and the Mississippi river, though its full depth will probably not be required for that purpose. Congress has not adopted any scheme for this improvement, but by its direction a survey was made, and plans with estimates for a waterway 14 feet deep were submitted, by a board of engineers in a report dated August 26, 1905. The board found that for a distance of about 100 miles from Chicago the improvement must be with locks and dams, and as the quantity of water required would be merely that needed for the service of locks and other incidentals, the extent of the improvement or depth which could be obtained in that part of the route was without limit so far as it depended upon the amount of water available. For the remaining distance, about 223 miles, the improvement would be an enlargement of the open channel and the degree to which it was practicable was entirely dependent upon the quantity of water flowing. The board assumed that the Chicago Drainage Canal would eventually be permitted to take 10,000 cubic feet per second from Lake Michigan, and it expressed the opinion that with that volume added to the natural low water discharge of the Illinois river a depth of 14 feet in the open channel could be maintained; also that if a much greater depth was to be secured a much larger volume of water must be taken from Lake Michigan.

16. In the neighbourhood of Lockport the natural level of the ground falls away rapidly and excellent facilities are found for the development of water power. Under the state legislation of 1903 the sanitary district is now engaged in utilizing this incidental advantage of the drainage canal. The plans provide for an extension of the canal 10,700 feet between concrete walls and earth and rock embankments to the site selected for the power-house and for the excavation of a tail race 6,800 feet long, 160 feet wide, and 22 feet deep. If the maximum quantity of water which the sanitary district now claims to be necessary for sanitary purposes —14,000 feet per second—be utilized it will be possible to develop about 40,000 electrical horse-power under a head of 34 feet. With 10,000 cubic feet per second about 28,000 horse-power can be developed. A power-house is being erected which will accommodate 8 turbines, each capable of generating 5,000 horse-power.

17. The sanitary district has acquired land on both sides of the canal throughout its length, the width of the strips varying from 200 to 800 feet. This land is offered to manufacturers at moderate prices, and it seems probable that they will in the course of time be attracted thereto, particularly after arrangements for furnishing them with cheap power from Lockport are completed.

18. The diversion of large bodies of water from Lake Michigan for supplying the drainage canal has not been authorized by Congress. The plans of the sanitary district, except those for the enlargement of the Chicago river, have not been submitted to any Federal authority for approval. It was only after the opening of the canal that application was made to the Secretary of War for permission to divert the quantity of water required by the State law. The Secretary granted permission for such quantity as would pass through Chicago river without detriment to navigation, a quantity considerably less than that required by the State law. After experimenting with various amounts it was fixed at 250,000 cubic feet per minute, or 4,167 cubic feet per second, and that is the amount now authorized. It is 'subject to such modification as, in the opinion

of the Secretary of War, the public interests may from time to time require.' Copies of all the permits granted by the Secretary of War in this connection will be found in Appendix D.

19. In the expenditure of $40,000,000 for the drainage canal the people of Chicago, with its population of 2,000,000, incurred a burden equivalent to that due to an expenditure of $1,600,000,000 by the United States, with its population of 80,000,000—that is, enough to build eight or more Panama canals. It was a very serious effort and has commanded the admiration and sympathy of all observers. The diversion of 10,000 cubic feet per second from Lake Michigan affects other interests adversely, but these interests have withheld their opposition, seeming to believe that some such amount was necessary, and apparently willing to contribute their share to protect the lives and health of the prople of a great city. The plans calling for that amount have been under public discussion for some years. Although withholding formal approval, the Federal authorities have taken no steps to prevent their execution. Congress has called for a plan and estimates for an improvement of the waterways conuecting with it, the scope of which is fixed by that amount. There appears to be a tacit general agreement that Chicago needs or will need about 10,000 cubic feet of water per second for sanitary purposes and that the city should have it without further question.

20. It was not generally known until after the publication in March last of the report of the American section of this Commission upon Niagara Falls that an amount greater than 10,000 cubic feet per second would be asked for. In that report, subsequently concurred in by the Canadian section, it was recommended that the diversiou of 10,000 cubic feet be allowed. The preservation of Niagara Falls alone was considered, and that in the light of the tacit agreement above described. It was supposed at the time that this was all that Chicago needed, but the recommendation gave offence to the officials of the sanitary district, and the further demand then came out in the form of appeals to the committees of Congress and to the Secretary of State. It is necessary now to take up the question anew, and, after considering it in all its bearings, to reach some conclusion as to whether there should be a limit to the amount of water to be diverted at Chicago, and, if so, as to what that limit is.

21. That the abstraction of water from Lake Michigan has a tendency to lower the level of that lake and of all the waters to which it is tributary is self-evident; but the exact effect of abstracting a given amount can be ascertained only from prolonged observation of the natural outlets under the varying conditions to which they are subjected during a series of years. An elaborate investigation of this subject was made under the office of the United States Lake Survey in Detroit, the results of which were published in the anuual reports of the Chief of Engineers for 1900, page 5401; for 1902, pages 2779 and 2825; and for 1904, page 4120. Further observations are needed to be made when the difference of level between Lake Erie and Lake Huron is greater or less than when the existing observations were made, but the results obtained from the latter are believed to be reliable within one-tenth of a foot. The amounts by which the mean level, as derived from observations of the last forty-six years of various waters will be lowered by a discharge of 10,000 and also by 14,000 cubic feet per second are given iu the followiug table:—

Location.	Water level lowered by diversion at Chicago of—	
	10,000 cubic feet per second.	14,000 cubic feet per second.
	Inch.	Inch.
Lakes Huron and Michigan	3·52	0·70
Lake St. Clair	0·45	0·64
Lake Erie	0·45	0·64
Lake Ontario	0·35	0·49
St. Lawrence River and Rapide Plat	0·40	0·56

From this table it appears that all the waters, including Lakes Michigan and Huron, Lake St. Clair, Lake Erie, Lake Ontario, and the St. Lawrence river, besides the important connecting channels, the Detroit and St. Clair rivers, will be lowered by amounts varying from 4¼ to 6¼ inches for 10,000 cubic feet and from 6 to 8½ inches for 14,000 cubic feet per second. The length of time required to produce this effect is about five years; about half of it will be produced at the end of eighteen months. The above figures give the effect at average level; they are much more considerable during low water periods.

22. Variations in the level of the lakes' surface, due to winds and to change of barometric pressure, are frequent and irregular and at times violent. Variations of more than 6 inches are very common, often occurring hourly for many hours in succession, while variations of 2 or 3 feet within an hour are not uncommon. Besides these irregular variations there is a regular annual variation due to difference in rainfall, evaporation, and run-off, the water level being highest in midsummer and lowest in midwinter. The levels are affected also by the greater or less severity of the winter and the consequent greater or less decrease in the discharging capacity of the outlets by ice. In order to study the annual oscillations it is necessary to eliminate the irregular oscillations, and that is accomplished by using the average levels for a month. Using the monthly mean levels it is found that the regular fluctuation in Lake Huron-Michigan usually does not exceed 2 feet in any one year, but in a long series of years there is a great difference in the height to which high water will rise. The highest water (monthly mean) recorded for that lake was in June, 1886, and the lowest high water in June, 1896, the difference between the two being over 3½ feet. The first is what navigators of the Great Lakes call a high-water year and the second a low-water year.

23. It is evident that the average level of the lake may be lowered considerably without the change becoming immediately apparent, and that fact has been used as an argument to prove that the lowering caused by the Chicago Drainage Canal is of no consequence to those interested in navigation. Since they can not see it they will not know it and will not feel it. The argument is fallacious. It is true that they can not see it immediately, but they will soon feel it and will know it through the most costly means of acquiring knowledge—the injury to their material interests. The oscillations will remain the same as before, but low water will fall lower and high water will rise less high. The average draught of vessels must be diminished by the amount that the average level is lowered unless the depth be restored by remedial works.

24. The most important lake traffic is now carried on in large freight carriers which are loaded down to the greatest draught that can be carried into the harbours or through the channels between the lakes. With the depth now available

they are usually loaded to a draught of about 19 feet, but careful watch is kept on the stage of the waterways and advantage is taken of any temporary increase of stage to load the vessels deeper. In the modern vessel each inch of increased draught adds about 50 tons to the carrying capacity. To lower the water surface 6 inches is to reduce the capacity of the vessel about 300 tons. If the freight rate on iron ore be taken at 55 cents per ton, exclusive of the cost of loading and unloading, and the number of trips during the season at 22, there appears a loss of over $3,600 for the season for each vessel. The number of vessels navigating the Great Lakes which draw 19 feet or more is 417, and their tonnage is 1,541,414 tons, which is about three-quarters of the total tonnage of the Great Lakes. It is a conservative estimate that the loss to the navigation interest resulting from a reduction of 6 inches in the depth of water is $1,500,000 per annum, which, capitalized at 4 per cent, amounts to a loss of $37,500,000. With a greater reduction of depth the resulting loss would be proportionately greater. The number of deep-craft vessels and the share of lake traffic which they carry is increasing each year, while the lake traffic itself is increasing with marvellous rapidity. The total number of tons of freight which passed through Detroit river in 1905 was about 58,000,000, valued at about $615,000,000. The records for the year 1906, so far as they are made up, indicate that the number of tons which passed through the Detroit river in 1906 exceeded 65,000,000, valued at $690,000,000. The loss will be even greater in the future than it is now. It is quite certain that the loss will not pass unnoticed, and that the governments will be compelled to restore the depth either by additional excavations or by regulating works.

25. Careful estimates have been made of the cost of deepening the channels between the lakes 1 foot. To deepen the Detroit river is estimated to cost $4,115,430. In Lake St. Clair the full depth of the lake is now utilized, and any lowering of its surface involves the excavation of an artificial channel entirely across the lake, a distance of 18 miles, of which it has been necessary heretofore to artificially deepen only one-third. To deepen the channel here and at certain shoal places in St Clair river and at the foot of Lake Huron is estimated to cost $1,080,720. It results in replacing open lake navigation by canal navigation for a distance of 12 miles in Lake St Clair, a decided disadvantage.

26. The data are not at hand for an accurate estimate of the cost of restoring the depths in the harbours of the Great Lakes, but an approximation may be reached from a consideration of the cost of improvements heretofore made. The depth to be gained being small, the cost will not vary largely, whether that gain be a few inches more or less. The United States has improved thirty-five harbours on Lakes Michigan, Huron and Erie, and has expended thereon about $20,000,000, of which about one-quarter was for maintenance. The average increase of depth is 10 feet and the cost per foot of increase was therefore about $1,500,000, but as the cost of a small increase would be much greater per foot than an increase of 10 feet, and as several harbours on Lake Ontario are to be added, the cost per foot in this case would probably be not less than $2,000,000 for harbours in the United States. The Canadian government has improved over fifty harbours on Georgian bay, Lakes Huron, St. Clair, Erie and Ontario. A large amount, say $3,000,000, must be added for increasing the depth of these harbours.

27. The depth in the Welland canal and in the six canals employed to overcome rapids in the St. Lawrence river is now 14 feet, of which every inch is needed. At the head of the Cornwall canal in the St. Lawrence river the abstraction of 14,000 cubic feet of water per second at Chicago will lower the surface about 6¾ inches at mean level and much more at low water. To restore the depth in these canals involves the reconstruction of all the end locks and deepening the approaches thereto, and is estimated to cost $2,500,000.

28 The total cost of restoring the depth in the harbours of the Great Lakes and the channels between the lakes is therefore roughly $10,000,000, and of restoring it in the Welland and St Lawrence canals is $2,500,000 additional, or $12,500,000 in all

29. The shores of the Great Lakes are very far from being fully developed, and it is highly probable that many harbours not now in existence remain to be created, or if in existence remain to be improved. The lowering of the lakes' surfaces increases the difficulty and cost of such improvements. This consideration is of importance, although no money value can now be given it.

30. The expenditure of the sums mentioned above will restore the depths now existing, but it will not prevent very serious annoyance to the navigation interests during the execution of the work. The time required will be several years, and in the meantime the vast commerce of the Great Lakes will be hampered, not only by deficient depth, but also by the occupation of the channels, already crowded with commerce, by the excavating machines.

31. It is evident from the foregoing that large bodies of water can not be diverted by the Chicago drainage canal without very serious detriment to the navigation interests of the Great Lakes and of the St. Lawrence valley. The greater the amount of water diverted the greater the injury. Chicago being one of the principal lake ports, there will be very few communities which will feel this detriment more than she will.

32. In the presence of these interests the effect upon Niagara falls may be simply mentioned with a reference to our former reports upon that subject. The volume of Niagara falls will be reduced by the full amount diverted at Chicago.

33. The city of Chicago was organized as a city in 1837, with a population of about 4,000. Its population in 1840 was 4,479; in 1850, 28,269; in 1860, 112,172; in 1870, 298,977; in 1880, 503,185; in 1890, 1,099,850; and in 1900, it was 1,698,575. It is estimated now to be about 2,000,000. Should the rate of growth continue which prevailed between 1880 and 1900, the population will be 3,000,000 in the year 1922 and 4,000,000 in the year 1939. It is impossible to foretell its future growth, but there is no reason to doubt that it will in time greatly exceed the largest of these numbers. The city is the commercial centre of an empire still in its infancy. It is entirely reasonable to expect a population of five or six millions or more. It will cover territory not now covered. Methods of sewage disposal appropriate to one portion of it may not be appropriate to other portions. If the diversion of 20,000 cubic feet per minute (or $333\frac{1}{3}$ cubic feet per second) for each 100,000 of population, as required by the State law, is accepted as the standard, then from 17,000 to 20,000 cubic feet per second will be required, and the 14,000 cubic feet now contemplated will not be sufficient. Even more than 20,000 cubic feet will be required for a population greater than 6,000,000. The diversion of 20,000 cubic feet per second would lower Lakes Michigan and Huron about 13 inches and Lake Erie about 11 inches. Plans which lead to this result should be carefully scrutinized.

34. One of the reasons given in 1889 for adopting this method of disposing of Chicago sewage was that it offered the advantage of furnishing a navigable waterway from Chicago to the Mississippi river. The navigable depth or capacity of such a waterway has never been authoritatively fixed. Congress has considered a depth of 14 feet to the extent of ordering a survey and estimates of cost for that depth, but the Illinois legislature has declared its policy to be to secure the construction of a deeper channel, not limiting its proposed capacity in terms, but defining it to be 'of the greatest practicable depth and usefulness for navigation.' See joint resolutions adopted May 27, 1889, copy omitting preamble hereto appended, marked 'E'. A fair interpretation of this language gives a proposed depth of 20 feet, that being the depth required to accommodate the most important vessels now navigating the Great Lakes. It will require

a volume of water greater than the 10,000 cubic feet per second originally contemplated.

35. The amount which it is proposed to divert from the Calumet river, 4,000 cubic feet per second, is fixed by accident rather than by design, being the excess which the Chicago drainage canal is found capable of carrying after providing for the 10,000 cubic feet from the Chicago river, for which it was originally constructed. It is certain that no greater amount than 4,000 cubic feet can be diverted from the Calumet without checking the flow from the Chicago river, and thus giving relief to a suburban portion of the city at the expense of the richest and most populous centres.

36. It is equally certain that the diversion of 4,000 cubic feet or less will not at all times afford the desired relief to the Calumet. In the first place it provides for a population of only 1,200,000, a number which will in all probability be greatly exceeded at a day not remote. At present the population is estimated at about 200,000, but for the present necessities it is not a question of population but of drainage area and rainfall. A flood discharge of the Calumet has been measured at Riverdale, about 10 miles from its mouth, of about 13,300 cubic feet per second from a drainage area of about 700 square miles, and even that amount may at times be exceeded. The total drainage area of the Calumet region, including the Sag valley, is about 825 square miles, and assuming the discharge to increase in proportion to the area, the flood discharge to be provided for is over 15,700 cubic fect per second. The diversion of only 4,000 cubic feet will not prevent a heavy discharge into Lake Michigan in time of flood. To overcome this difficulty it is proposed, if suitable legislation can be secured, to divert the upper Calumet into Lake Michigan through an artificial channel to be excavated in Indiana about 17½ miles east of the State line. Indiana has not authorized such diversion, but supposing it to be accomplished, there will still be times when the discharge from the drainage area remaining to be cared for by the canal, 238 square miles, will exceed 4,000 cubic feet per second. The excess must enter Lake Michigan through the mouth of the Calumet, and at such times the system will fail. Of course, it makes no provision for the future occupation of the upper Calumet region and the pollution of the lake from that source. It thus appears that the diversion of the Calumet river as now proposed by the sanitary district will not be complete even for the present, and will not make adequate provision for the future.

37. The diversion of 4,000 cubic feet per-second provides for a population of 1,200,000 by the standard fixed by the State law. The population of the Calumet region is now about 200,000, and until it reaches 1,200,000 only a part of the flow will be needed for sanitary purposes during a large part of the year; but the channel must be there, available for the full flow, if this method of sewage disposal is to be useful to any population, however small. Likewise the channel from the Chicago river must be, as it is, large enough to provide for a population of 3,000,000, whether that number of people are ever to become tributary to the Chicago river or not. The channels having once been constructed, any reduction of flow below their fullest capacity is a dead loss to the water-power dependent upon them. It has been said that it would be absurd to develop water-power at the cost per horse-power which this water-power costs if the drainage canal be included, and that is true. But being given the channels, it would not be absurd to use them to their fullest capacity. The Chicago Drainage canal having been constructed with a capacity, as it turns out, of 14,000 cubic feet per second, full power development will call for the whole of that amount, and in fact power works are now under construction at Lockport to utilize it. Inasmuch as the sanitary requirements by the standard, fixed in the State law, are only 6,667 cubic fcet per second for the present population of 2,000,000, it is evident that power development, incidental though it be, does lead to demands for water not required for sanitary purposes.

38. It remains to be seen whether any diversion, complete or otherwise, is necessary to preserve the health of Chicago. Upon this point the commission sought the advice of two eminent sanitary engineers—Messrs. Rudolph Hering and George W. Fuller—whom it instructed as follows, viz.: 'To examine the sanitary situation at Chicago, so far as it is affected by sewage disposal, and to report whether it is or is not necessary to the health of the city to extend to outlying territory the system which was adopted in 1889 for the main city. *** The commission desires an emphatic opinion from authoritative sources as to whether the system of diverting the water of Lake Michigan in large quantities into the Illinois Valley is the only way to preserve the lives and health of the people of Chicago. It does not desire an investigation of the effect upon the navigation intcrests of the Great Lakes. It has satisfied itself upon that point. Nor does it wish to reopen the case of the Chicago Drainage Canal as designed and built. It accepts that as a fixed fact, with its attendant diversion of 10,000 cubic feet per second through the Chicago river. The extension of the system to the Calumet river alone is in question, and the question is: Are there not other methods of sewage disposal which can be applied here at a cost not exceeding much, if at all, the cost of the method proposed, and which will be equally effective in preventing the pollution of the lake? It desires a report upon the various systems which may be found available for application here, with a statement of their relative efficiency. It also desires a statement of their relative cost, so far as that can be given, without the preparation of detailed plans. The latest conclusions of sanitary engineers as to the amount of dilution which is required to make sewage inoffensive should be given.' These gentlemen visited Chicago, and after a thorough examination of the situation submitted a report, of which a copy is hereto appended, marked 'F.' The entire report should be carefully studied. Its conclusions only are here quoted. They are ss follows, viz.:—

'The latest conclusions of sanitary engineers as to the amount of dilution which is required to make sewage inoffensive are that a dilution of 3 1-3 cubic feet per second for each 1,000 persons connected with the sewers, as provided for in the enactment of the Illinois legislature in 1889, is as low a figure as it is now possible to state. We believe that with the elimination of objectionable trade wastes and the occasional dredging of the river this amount of dilution will be sufficient to prevent offensiveness.

'The extension of the dilution method to the outlying territory is not the only way to preserve the lives and health of the people of Chicago. The application of this method, with flow of 10,000 and 14,000 cubic feet per second, respectively, for the area tributary to the present drainage canal, will serve populations not exceeding 3,000,000 and 4,200,000 respectively. For greater populations other methods of sewage disposal will be required.

'For the Calumet area, as well as other districts, there are several methods for the disposal of sewage as effective as the present method of dilution in preventing the pollution of the lakes waters.

'All these methods involve intercepting sewers and pumping stations to collect and deliver the sewage at suitable sites. Septic tanks are used for partially clarifying the sewage, which may then be applied to any one of three methods of filters, viz , intermittent sand filters, contact filters, and sprinkling filters.

'All of these filters if well built and well managed remove the suspended and organic matters so that the effluents are practically clear and non-putrescible. The removal of bacteria by these three types of filters averages at least 98, 80, and 90 per cent respectively. Such effluents may be discharged into any of the water courses of the Calumet region.

'The approximate total costs, liberally estimated, without the preparation of detailed plans, for a population of 1,200,000, are as follows:—

'A —*Intermittent sand filters.*

Construction	$11,063,000
Annual cost of operation, $866,000, capitalized at 5 per cent	17,320,000
	$ 28,383,000

'B.—*Contact filters.*

Construction	$ 11,787,500
Annual cost of operation, $551,000, capitalized at 5 per cent	11,020,000
	$ 22,807,500

'C.—*Sprinkling filters.*

Construction	$ 9,257,500
Annual cost of operation, $419,000, capitalized at 5 per cent	8,380,000
	$ 17,637,500

'The present population on the Calumet area of the sanitary district being less than 200,000 would naturally require but a portion of the cost of estimated works and of their operation to be expended at the outset.

'Of the available methods of disposing of the sewage of the Calumet area other than by dilution, the sprinkling filter method, being the cheapest both in cost of construction and of operation and accomplishing an adequate degree of purification, is clearly the most advantageous one.'

These engineers stand in the front rank of their profession as sanitary experts. One of them, Mr. Hering, was chairman of the commission of 1887, whose report to the mayor and city council of Chicago was the foundation of the subsequent legislation and led to the construction of the drainage canal. The conclusions reached are those of friends of Chicago, and not of her enemies or rivals.

39. A method of sewage disposal for the Calumet region is proposed which for a population of 1,200,000 is estimated to cost $17,637,500. For the present population of about 200,000 only a part of the expense need be incurred, and the works can be developed as the population increases. It can, when the necessity arises, be applied with a population much exceeding 1,200,000. The cost of diverting the Calumet river into the Chicago drainage canal is estimated at $12,000,000. The greater efficiency at present and in the future of the method now proposed would justify a considerable increase of cost, but in view of the fact that the entire expense of the diversion must be incurred at the outset, while by the new method the expenditures will be regulated by the growth of population, the difference in cost may be considered unimportant.

SUMMARY.

40. The following is a summary of the more important facts recited in this report:

(*a*) Chicago obtains its water supply from Lake Michigan, and to avoid polluting it must either dispose of its sewage otherwise than in the lake or place its intakes for water at a great distance from the city.

(*b*) The topography of the country favours the discharge of the sewage into the Des Plaines river, a tributary of the Mississippi, through two depressions in the divide which separates that river from Lake Michigan.

(*c*) The slope on the lake side of the divide is drained by two streams, the Chicago river and the Calumet river, into which the sewers of the city empty. By a cut through the northerly depression the flow of the Chicago river has been reversed and diverted into the Des Plaines river instead of into Lake Michigan, and by a cut through the southerly depression the same process can be applied to the Calumet river.

(*d*) To make this reversal effective the channels must be large enough to take all the water which falls upon the respective drainage areas during the most

violent rain storms. This amount is estimated at 10,000 cubic feet per second for the Chicago river and 15,700 cubic feet per second for the Calumet river.

(*e*) The city of Chicago was originally built upon the Chicago river, and that stream now drains the richest and most populous part of the city. It is now spreading over the Calumet region.

(*f*) In 1889 the plan of diverting the Chicago river into the valley of the Des Plaines was definitively adopted, and the Chicago drainage canal was undertaken. It was designed to carry 10,000 cubic feet per second. Though not entirely completed, it has been in use since January, 1900. The amount expended upon the canal and accessory work is about $41,000,000.

(*g*) The Illinois law which authorized the canal required a flow of 333 cubic feet per second for each 100,000 of population in order to render the sewage inoffensive. This amount of dilution is probably not excessive. It is reasonable to expect a population in a future not remote of five or six millions or more, involving the diversion by this standard of some 20,000 cubic feet per second. The Chicago river with its 10,000 cubic feet provides for a population of 3,000,000. The present population of the city is about 2,000,000.

(*h*) It is now proposed to apply to the Calumet river a treatment similar to that applied to the Chicago river, viz.: to reverse its flow; so that instead of discharging into Lake Michigan it shall discharge into the Des Plaines, but for a part of the new route it must follow the drainage canal already excavated for the Chicago river.

(*i*) Although the Chicago drainage canal was designed to carry 10,000 cubic feet per second, it is found to have, in its completed rock portion, an actual capacity of 14,000 cubic feet. This additional capacity fixes the amount which it is proposed to divert from the Calumet at 4,000 cubic feet per second. Any greater amount from the Calumet will overtax the drainage canal at the expense of the richest part of Chicago and for the benefit of a suburban part.

(*k*) The diversion of only 4,000 cubic feet will not be effective at all times, since a much greater amount must be diverted from the Calumet during heavy rain storms if the lake is to be protected. Moreover, it provides for a population not exceeding 1,200,000, which number will probably be exceeded at a date not far distant.

(*l*) The large channels necessary to provide for the contingencies of rain storms are capable of discharging a volume of water largely in excess of sanitary requirements during the greater part of the year, but the development of water power creates the demand that they be employed to their full capacity throughout the year.

(*m*) The diversion of large bodies of water from Lake Michigan for supplying the drainage canal has not been authorized by Congress, but there appears to be a tacit general agreement that no objection will be made to the diversion of 10,000 cubic feet per second, as originally planned.

(*n*) The diversion of 10,000 cubic feet per second will lower the levels of Lake Michigan-Huron, Lake St. Clair, Lake Erie, Lake Ontario, and the St. Lawrence river, besides the important connecting channels, the Detroit and St. Clair rivers, by amounts varying from 4¼ to 6¼ inches for the different waters, and the diversion of 14,000 cubic feet will lower them from 6 to 8½ inches. The diversion of 20,000 cubic feet will lower Lake Michigan-Huron about 13 inches and Lake Erie about 11 inches.

(*o*) The lake traffic which passed through the Detroit river in 1905 was about 58,000,000 tons, valued at about $615,000,000. It is increasing annually with marvellous rapidity. The records for the year 1906, so far as they are made up, indicate that the number of tons which passed through the Detroit river in 1906 exceeded 65,000,000, valued at $690,000,000. The lowering of the water surface has a very injurious effect upon this traffic, and upon that of the Welland

and St. Lawrence canals. Chicago being one of the principal lake ports, there will be very few communities which will feel the injury more than she will.

(*p*) The cost of restoring the depth in the harbours of the Great Lakes and the channels between the lakes is estimated at $10,000,000, and of restoring it in the Welland and St. Lawrence canals at $2,500,000. This expenditure would not prevent very serious annoyance to the navigatiou interests during the execution of the remedial works, which would occupy several years. In Lake St. Clair navigation of the open lake would be replaced by that of an artificial channel or canal with submerged banks.

(*q*) The extension to the Calumet region of the method of sewage disposal already applied to the Chicago river is not necessary to preserve the health of Chicago, there being other and better methods available for the Calumet region. The final cost of these methods is somewhat greater than that of the one proposed, but the works can be developed as the population increases, and only a part of their cost need be incurred at present, while their greater efficiency justifies the increase of final cost.

(*r*) The diversion of 10,000 cubic feet of water per second at Chicago will render practicable a waterway to the Mississippi river, 14 feet deep. Any greater depth must be obtained by the abstraction of more water from Lake Michigan and at the expense of the navigation interests of the Great Lakes and of the St. Lawrence valley.

(*s*) The effect upon Niagara falls of diverting water at Chicago is of secoudary importance when considering the health of a great city and the navigation interests of the Great Lakes and of the St. Lawrence valley, but it is proper to note that the volume of the falls will be diminished by the full amount diverted at Chicago.

RECOMMENDATIONS.

41. The waters of Lake Michigan in the United States, the waters of Georgian Bay in Canada, and the waters of Lake Superior partly in the Unitcd States and partly in Canada, all form sources of supply of the Great Lakes system, finding their way by the St. Lawrence to the sea. All are interdependent and there can be no diversion from any of them without injury to the whole system. By Article XXVI of the treaty of 1871 it is provided that 'navigation of the River St. Lawrence, ascending and descending from the forty-fifth parallel of north latitude, where it ceases to form the boundary between the two countries, from, to, and into the sea, shall forever remain free and open for the purposes of commerce to the citizens of the United States, subject to any laws and regulations of Great Britain, or of the Dominion of Canada, not inconsistent with such privileges of free navigation.' It is desirable that in any treaty arrangement the waters of Lake Michigan, Georgian bay, and all other waters forming part of the Great Lakes system should be declared to be 'forever free and open for the purposes of commerce' to the citizens of the United States and the subjects of His Britannic Majesty, subject to any laws and regulations of either country not inconsistent with such privilege of free navigation.

42. The preservation of the levels of the Great Lakes is imperative. The interest of navigation in these waters is paramount, subject only to the right of use for domestic purposes, in which term is included necessary sanitary purposes. In our report of November 15, 1906, upon the application of the Minnesota Canal and Power Company to divert certain waters in Minnesota we recommended, among other things—'that any treaty which may be entered into should define the uses to which international waters may be put by either country without the necessity of adjustment in each instance, and would respectfully suggest that such uses should be declared to be (*a*) uses for necessary domestic and sanitary purposes; (*b*) service of locks for navigation purposes; (*c*) the right

to navigate.' It is our opinion that so far as international action is concerned a treaty provision of that kind is all that is required in this case. We accordingly renew our recommendation of November 15, 1906, just quoted.

43. A careful consideration of all the circumstances leads us to the conclusion that the diversion of 10,000 cubic feet per second through the Chicago river will, with proper treatment of the sewage from areas now sparsely occupied, provide for all the population which will ever be tributary to that river, and that the amount named will therefore suffice for the sanitary purposes of the city for all time. Incidentally it will provide for the largest navigable waterway from Lake Michigan to the Mississippi river, which has been considered by Congress.

We therefore recommend that the Government of the United States prohibit the diversion of more than 10,000 cubic feet per second for the Chicago Drainage Canal.

All of which is respectfully submitted.

GEO. C. GIBBONS,
Chairman, Canadian Section.

O. H. ERNST,
Chairman, American Section.

W. F. KING,

GEORGE CLINTON,

LOUIS COSTE,
Members, Canadian Section.

E. E. HASKELL,
Members, American Section.

Attest: W. EDWARD WILSON, *Secretary, American Section.*
THOMAS CÔTÉ, *Secretary, Canadian Section.*

APPENDICES.

A.—Report dated January, 1887, to the mayor and city council of Chicago, of the commission appointed to examine the drainage and water supply.
B.—Letter dated June 29, 1906, from Mr. Lyman E. Cooley, civil engineer, formerly chief assistant to the commission of 1887.
C.—Statement of expenditures by sanitary district of Chicago to December 31, 1905.
D.—Copies of all permits issued by the Secretary of War to the sanitary district of Chicago.
E.—Joint resolution of Illinois legislature adopted May 27, 1889.
F.—Report of Messrs. Rudolph Hering and George W. Fuller upon methods of sewage disposal available at Chicago.

APPENDIX A.

CHICAGO, January, 1887.

To the Honourable Mayor and City Council of the City of Chicago:

GENTLEMEN,—On January 27, 1886, your honourable body passed a resolution authorizing the creation of a drainage and water supply commission. After being amended, February 23, it read as follows:—

'Whereas, pure water and scientific drainage are necessities of this community, and the people demand a system of water supply and drainage adequate to meet the requirements not only of the present but of years to come, nor will any temporary expedient or makeshift satisfy them; and

'Whereas, a thorough and permanent system of supplying pure water to our citizens and caring for the drainage of the municipality can not be paid for out of current taxation, therefore it is desired that a plan shall be devised and perfected before the next meeting of the legislature to the end that necessary legislation may be had.

'For the purpose of carrying into effect the objects sought, there is recommended the appointment by the mayor of a commission to consist of one expert engineer, whose reputation is so high that his opinion and report will command the respect of the community, and with him one or two consulting engineers of like experience in engineering and sanitary matters. The duty of this drainage and water supply commission, made up as above set forth, should be to consider all plans relating to drainage and water supply which may be brought to its attention; to make such examinations and investigations and surveys as may be deemed necessary; to collect all information bearing on this problem; to consider all recent developments in the matter of sewage disposal, and their application to our present and future needs; to consider and meet necessity of increasing our water supply and of protecting the same from contamination; to remedy our present inadequate methods of drainage and sewage disposal; to consider the relations of any system proposed to adjacent districts, and whether there may not be a union between the city and its suburbs to solve the great problem; to determine the great question as to the interest which the state and the United States may have in the disposal of sewage by way of the Illinois river, and to devise plans to meet any objections thereto, if such a system shall be thought best; and in general to consider and report upon any and all things which relate to the matter of water supply and drainage of the city of Chicago.

'The commission should report on the whole matter committed to it in the most full and comprehensive manner, with maps, plans, and diagrams complete, and accompany the report with estimates of the first cost and annual requirements for the maintenance of the system proposed.

'The report of the commission should be made as early as practicable, and not later than the convening of the next session of the Illinois legislature in January, 1887.

'In consideration of the foregoing, be it

'Resolved, That the mayor be, and is hereby, authorized and directed to employ on behalf of the city one expert engineer of reputation and experience in engineering and sanitary matters, at a salary not to exceed $10,000 per annum, and also to employ such consulting engineers, not exceeding two in number, as may seem necessary, and such assistant engineers as may be required, all to be paid according to services rendered, for the purpose of carrying out the objects set forth in the preamble hereto. For the fees of said assistant engineers and for all expenses connected with said work there shall be allowed not to exceed the sum of $20,000. All fees, salaries, and expenses connected with said work shall not exceed in the aggregate the sum of $30,000, and the same shall be paid from the fund of the city upon vouchers audited by the mayor and city comptroller.'

In accordance with the terms expressed herein his honour Carter H. Harrison appointed Rudolph Hering as chief engineer, Benezette Williams and S. G. Artingstall as consulting engineers, who together should constitute a commission. Mr. Hering entered upon duty March 28, Mr. Williams, September 17, and Mr. Artingstall, December 21, 1886.

The investigation designated by the resolution was a formidable one, comprising no less a task than the consideration of the entire subject of the future water supply and drainage of Chicago. It appeared doubtful from the beginning that a report such as was demanded could be furnished within the specified time, for the simple reason, if for no other, that observations of the lake phenomena and of the flow of certain rivers should be extended over at least one year, covering consecutive four seasons, in order to draw satisfactory deductions.

But the large amount of work alone that was asked for made it impracticable to present a complete report in so short a time. It was expected, however, that results could be reached sufficient to indicate the character of legislation required to carry out any project that might be determined upon, and that therefore a preliminary report having this end in view could be made at the stated time, leaving to a later date the presentation of a report outlining the detailed features of the scheme recommended and embracing the minor results of the entire inquiry.

The present communication is to cover the ground indicated for the preliminary report, and besides containing the conclusions reached regarding the main features of the proposed project, it contains also a brief review of the work done during the past year and of what still remains to be done.

The month of April was devoted to a general examination of the subject of the territory to be investigated, and of the various suggestions that had been made toward effecting a solution of the problem.

The examination disclosed the fact that the city is sometimes greatly suffering from the offensive condition of parts of the Chicago river and its branches, caused by the discharge of sewage into the same, and from the occasional contamination of its water supply, brought about by the discharge of the polluted disclosed contents of the river into the lake. It showed also the fact that almost every conceivable way of dealing with these questions had been suggested and in some forms applied during the past thirty years.

The problem therefore demands the attainment of two ends—the protection of the water supply and the removal of the river nuisance. As the water must be taken from the lake, it is evident that both its pollution and the objectionable condition of the rivers should be prevented by a better disposition of the sewage. It is, therefore, the latter question which constitutes the main object of this investigation.

Among the possible methods of getting rid of the Chicago sewage there are but three that have been deemed worthy of an extended consideration, namely: A discharge into Lake Michigan, a disposal upon land, and a discharge into the Des Plaines river. The preliminary work has, therefore, been confined to these three projects, and was classed as topographic, hydrographic, and miscellaneous.

At the time when the present commission began its labours the topographical work had already received some attention. Surveys were being made of the Des Plaines river from Bridgeport westward under the direction of Mr. Artingstall, city engineer. These surveys were continued, and have now been completed as far as Joliet. They include contours of the entire valley and borings to rock between Bridgeport and Lemont. In order to understand the hydrography of the Des Plaines valley above the point where the Chicago sewage could be discharged into it, and also to ascertain the probable magnitude and effect of floods in the river, a survey was made of its bed as far north as Northfield township. To determine the area of the basin its entire divide was located. To ascertain the practicability of diverting the flood waters from the upper portion of the Des Plaines and North Branch watersheds directly into the lake, and thus avoiding the difficulties which would arise from their passing through the Chicago river, all feasible lines were surveyed. Finally, a few levels were taken of the area adjoining the city wherever no connected levels existed to show the general topographical features of the territory over which the future city will spread out and from which the drainage will require artificial removal.

The hydrographic work consisted in ascertaining the flow of the Des Plaines river, the rainfall upon its area, its flood discharges, the character of its bed, and the probable effect of discharging the Chicago sewage into it when diluted by a large and constant stream of water from the lake. It consisted, further, in examining the nature of the currents in the lake and in studying the rise and fall of its level, and in ascertaining the amount and character both of the sewage dis-

charged into it and of the deposits in the river and lake in front of the city to determine the effects of the present sewage disposal.

Inquiries and surveys were made to show the feasibility of purifying the Chicago sewage by filtration on land. Land damages were carefully estimated for the different schemes; existing records were searched concerning borings and excavations made in and about the city, so that the practicability of certain lines of tunnels could be discovered; the probable growth of the city and its suburbs, as well as the probable distribution of the future population, received a careful attention, and, finally a large number of data were compiled which pertain to the existing works of water supply and sewerage in Chicago and the adjoining towns.

In reporting the result thus far gained we will present them in order most convenient for discussion, but before doing so will briefly describe the present manner and effect of the sewage disposal, as shown by this investigation.

PRESENT SEWAGE DISPOSAL.

The sewage works of Chicago and suburbs have been planned on what is called the combined system, in which the sewers serve for the removal both of sewage and rain water. In the town of Evanston they empty into the lake. In the town of Lakeview they partly discharge into the lake and partly into the North Branch. From the north and west divisions and part of the south division of Chicago, the drainage enters the Chicago river and its branches, and from the remaining part of the south division it flows into the lake at three outlets, situated respectively at Twelfth, Twenty-second and Thirty-fifth streets. The sewers of Hyde Park discharge into the lake, excepting those of Pullman, where the sewage is disposed of on land. The town of Lake, including the stock yards district, drains into the south fork of the Chicago river.

When the sewage works of this city were designed, in 1856, by Mr. E. S. Chesbrough, it was apprehended that ultimately some means would have to be found to change the water in the river from time to time or to keep the sewage entirely out of it. The first step toward improving the condition of the river was taken by deepening the Illinois and Michigan canal, so as to cause a current from the lake to the Des Plaines river at Lockport. The next step was the building of the Fullerton avenue conduit in order to produce a circulation in the north branch; and the last step was the erection of the canal pumping works to increase the flow in the river, which had become greatly polluted.

The influence of these works is confined to the main river and its north and south branches. But the south fork of the latter, receiving a large amount of sewage from Chicago and the town of Lake, and charged with the waste from the Union Stock Yards and packing houses, has no artificial means for a circulation of its water, and as a consequence is in a condition of great filthiness.

The accompanying diagram* has been prepared to show the present pollution of the Chicago river and its branches during the time when all of their water is discharged into the canal by the Bridgeport pumps. On the left are shown the main river and the north branch, one above the other, their combined waters forming the south branch, and reaching Bridgeport on the right, where they are lifted into the canal.

At the latter point the south fork is shown as joining it. The shaded portions indicate the amount of sewage entering and passing the respective points, and the blank portions the lake water diluting it. The degree of dilution is shown by the relative areas. It diminishes in the north branch from Fullerton avenue to the south branch, and becomes still less toward Bridgeport, and finally receives the foul waters of the south fork.

The depth and character of sewage deposits in the river and harbour, as might be expected, vary considerably. They are not great in the track of the

*Omitted; printed in House Ex. Doc. No. 264, 51st Cong., 1st sess.

vessels, but increase towards the docks and quieter portions of the slips, where they reach a depth of from 1 to 4 feet. While the deposits in the channel are of a heavier kind, such as cinders, those in the docks are mostly a foul mass of decomposing organic matter. No form of life is found to exist above Clark street bridge as far north as Clybourn place and as far south as Ashland avene. The effect of this condition of the river is to endanger the purity of the water supply whenever the river, with its accumulated deposits, flows into the lake, which occurs when the rain water that finds its way into the river exceeds the amount pumped into the canal. If this excess is great, as in the spring and occasionally in the summer months, the contamination of the lake is considerable, and must constantly increase.

From the foregoing it is seen that the present method of disposal of the sewage from Chicago and its suburbs is partly by discharging it into Lake Michigan, but mainly, except during floods, by discharging it into the Des Plaines river.

FUTURE POPULATION.

The first question which required an answer, and upon which many of the subsequent inquiries depended, was the population which it is economical and advisable to consider at present, and the extent of territory upon which such a population will be located.

The growth of Chicago has been frequently quoted as phenomenal. Estimates made thereof for various purposes have turned out to be rather under than over the actual result.

It is taken for granted that Chicago and its suburban towns will have to dispose of their sewage so that the water supply for the entire community residing near the lake from the south line of Hyde Park to the north line of Evanston will be guarded against pollution by the sewage from any one of its separate communities. For this purpose the whole populated area within the above limits is considered as forming one city with a common interest.

The growth of this metropolis was obtained partly from the United States census and partly from the school census of Cook county, which gave a record up to the summer of 1886. In order to forecast the probable ratio of the future increase it was desirable to compare this growth with that of other cities. By considering the ratio in increase elsewhere, and including the natural suburbs of each city, a fair and instructive basis of comparison was obtained; and by realizing the respective natural advantages for growth in each of the communities the probable ratio for Chicago was determined with a satisfactory degree of exactness.

The accompanying diagram shows the results of this comparison. It represents by curves the population of the largest cities in the country since 1790, not as usually quoted from the census, giving the inhabitants on certain arbitrary areas fixed by law, but as virtually making up the population of the respective municipalities, by including adjacent towns and natural suburbs, the only method which enables the true growth of the great cities to be recognized. For instance, the New York centre naturally includes Brooklyn, Jersey City, Hoboken, Newark and other suburbs, and Chicago, the entire territory from Hyde Park to Evanston.

The diagram indicates that the character of growth of the different cities permits them to be divided into two distinct classes. Philadelphia, Boston, St. Louis and Cincinnati show very much the same character of increase, and represent by comparison the more conservative communities. New York and Chicago, on the other hand, while showing a remarkable resemblance to each other, form quite a contrast to the rest of the cities, and might be called the more progressive communities. The diagram finally indicates the time when the

Chicago curve, which was the lowest one prior to 1864, intersected in turn those of St. Louis, Cincinnati, Boston, and there is a high degree of probability of its intersecting the Philadelphia curve in or before 1891—i.e., in four years from now —after which Chicago will be the second largest centre of population in America.

As it is not practicable in so young a city as Chicago to forecast a definite line of growth, it is preferred to give the probable maximum and the probable minimum between which the true line will most likely be contained. The minimum line represents a growth resembling that of New York, and the maximum line assumes the ratio of increase per decade to be constant instead of gradually decreasing as in most other cities. The result indicates that the population of Chicago and suburbs will be 2,500,000 between the years 1905 and 1915, or about three times the present population in eighteen to twenty-eight years.

In providing public works for large communities it must be borne in mind that it is economical to invest only such sums as will bring a return within a certain number of years, leaving expenditures for benefits that will be realized only at a later time to a later generation. This fact, together with the probable growth of Chicago, shows it to be economical and judicious at present to plan works sufficiently extensive to dispose of the sewage of not less than 2,500,000 inhabitants.

In addition to the population the area that will be occupied by it has to be determined. While this is a far more difficult task, owing to the many accidental causes influencing the distribution of the population, it is possible nevertheless to outline the area sufficiently close for present purposes.

The future metropolis, with a population three times as great, will be distributed along the lake from South Chicago to Evanston, and will reach inland to the Blue Island Ridge in the south to the Des Plaines river in the centre, and to the higher parts of Niles township in the north. Outside of these general limits, a more or less dense population will extend for some distance along the lines of railroad.*

As inferred above, it is proper to consider at this time the wants of the population that will reside upon this entire territory.

DISCHARGE OF THE SEWAGE INTO LAKE MICHIGAN.

To discharge the sewage from cities into comparatively large bodies of water is not only the usual, but often the best method for its disposal. Dilution and dispersion thoroughly expose it to the action of the oxygen contained in both the water and the superincumbent air; it is thereby gradually oxidized. Where the body of water is a large river with a strong current, the best conditions for such purification are found. Where it is a lake in which the circulation is slight and irregular, the efficacy of the method is less and depends for its success on the character of the currents and the relative amount of sewage to be discharged into it.

The hydrographic surveys of the lake made during the past season were therefore partly for the purpose of ascertaining, if possible, the laws governing the currents, so that we would know their effect in dispersing the sewage discharged into the lake. The trend of the shore currents was actually ascertained by daily recording the direction of spar buoys placed at the Chicago waterworks crib, at Michigan City and at St. Joseph. A large number of bottle floats were thrown into the lake at different points and different times for the same purpose. They were partly single surface floats and partly double, the lower one being placed at varying depths, according to the depth of the water. More than half of them have been picked up and returned, with place and date noted. The currents were also observed by means of large can buoys from an anchored

*Here occurs a diagram showing the growth of several population centres in the United States, not here produced.

tugboat at different points in the lake extending from Hyde Park to Evanston, about 6 miles from the shore. Two general lake trips were undertaken, one to St. Joseph and back to Grosse Point, and another one parallel with the shore around the head of the lake.

When the observations are completed and compiled in detail, some valuable information will be available for the question of water supply. Light will be thrown on the movement of the water under different winds and the sudden changes of temperature of the water at the crib and on the turbidness of the same.

The following results have a bearing on the question of sewage disposal: Where not affected by local conditions, the currents practically go with the winds in water of moderate depth and quickly respond to any change. In deep water also the surface currents run with the wind, but at the bottom and even at mid-depth the direction is usually different. The prevailing current along the shore of Cook county during the past summer has been observed to be toward the north, but it is possible that this result may be different during the winter months. In the open lake, wave action seems to be effective in preventing the permanent deposits down to a depth of about 60 feet; inside of the breakwater sewage deposits are found on the bottom.

The general deduction from these results is clear that, as no constant current exists which would carry the sewage away in one direction, it should be discharged into the lake at one end of the future city, while the water supply should be obtained as far away from it as practicable toward the other end, a conclusion which is being acted upon in the other large lake cities. The proper place from which to bring the water would be opposite Grosse Point, and the sewage discharge should be east of Hyde Park. While it might be practicable to allow the sewage in its crude form to enter the lake under such conditions for many years, the necessity would arise later for clarifying it at least partially previous to its discharge. It could not be allowed to run into the river as at present, but the dry weather flow and a considerable amount of storm water would have to be intercepted and carried to the outfall through many miles of special conduits. This entire quantity would have to be raised by pumping in order to get sufficient head to empty into the lake, while the diluted sewage during storms, in excess of the capacity of the intercepting sewers, would be allowed to discharge directly into the river.

The water supply would have to be brought from Grosse Point in large conduits to the several pumping stations scattered over the city and its present suburbs. The circulation of the water in the Chicago river and branches would have to be maintained practically as it is at present, because the removal merely of the dry-weather flow of sewage would not altogether prevent its pollution.

DISPOSAL ON LAND.

We shall not at this time enter into a general discussion of the principles underlying land purification of sewage, or make historical references showing the success or ill success of the method as practised elsewhere. We will simply state that with good management under ordinarily favourable conditions a disposal on land proves satisfactory, so far as the purifications of the sewage is concerned, and that with proper conditions in the way of good markets and a favourable soil and climate, sewage farms can be operated on a large scale after the sewage is delivered upon the same without financial loss.

In speaking of a sewage farm of the magnitude required for the metropolitan area of Chicago, it is not understood as being land devoted primarily to the raising of crops, using the sewage only when and where it would most promote the growth of vegetation. The primary object would be the purification of

the sewage on an area of land as small as could serve the purpose. Technically speaking, the sewage disposal would be by means of intermittent filtration rather than irrigation. To carry out such a scheme for Chicago involves the following:—

(1) The acquirement of sufficient land suitable for the purpose.

(2) A comprehensive system of intercepting and collecting sewers carrying the sewage to the farm.

(3) Pumping works of a capacity to handle all the dry weather flow of sewage and a certain proportion of storm water.

(4) A thorough underdrainage, levelling, and preparing of beds for the filtration areas.

(5) A system of underground conduits and surface carriers for distributing the sewage over the ground, and a system of open ditches for removing the purified water to the nearest water courses.

(6) Buildings, roads, and a complete farming outfit.

(7) An organization for properly distributing the sewage, for carrying on the farming operations, for conducting the business of disposing of the crops in the best market.

In making estimates for the size of intercepting sewers, conduits, pumps and area of land required we have used as a basis a population of 2,500,000 people, with an average dry-weather sewage discharge of 150 gallons, or 20 cubic feet, per head daily, and made provision for storm water equivalent to one-fifth of an inch in twenty-four hours over all portions of the district now drained or likely to be drained by a combined system of sewers, allowing surplus water to escape into the rivers and lakes.

The dry-weather flow of sewage would therefore be 50,000,000 cubic feet per day, and the maximum flow of storm water 65,000,000 cubic feet per day, making a total maximum discharge of 115,000,000 cubic feet.

From an examination of rainfall tables we conclude that the annual amount of storm water that would be carried off by such an intercepting system would range from 9 to 12 inches, an average of which in round numbers may be taken at 40,000 cubic feet per acre per annum over the area drained by a combined system of sewers. It is practicable, however, to exclude the storm water from the sewers over a large portion of the future city by adopting the separate system of sewage. The area north of the town of Jefferson and of the middle of Lakeview may be treated to advantage in this way, and also a large portion of Hyde Park, Lake Calumet, and other adjoining towns.

Assuming that the area which does not allow the storm water to be entirely excluded is 140 square miles, the average daily amount becomes 10,000,000 cubic feet, which gives, when added to the sewage, 60,000,000 cubic feet, or 24 cubic feet per head of population per day to be provided for on the farm.

As the amount of land required to purify sewage can only be determined by experience, and as this has been very limited in our own country, we are forced to rely mainly upon that of Europe. Without going into details at present, we will simply state that a fair consensus of this experience justifies us in the conclusion that from 10,000 to 15,000 acres of land would be required to dispose of the sewage from the entire metropolitan area.

The only available territory for sewage filtration in the neighbourhood of Chicago consists of two sandy ridges in the town of Thornton, extending across the state line into Indiana, and in a sandy ridge crossing the town of Niles. The soil is quite favourable, but the character of the surface is such that the necessary preparation to make it suitable for filtration beds would be comparatively expensive. An enormous cost is, however, represented by the fact that the sewage would have to be collected by large intercepting sewers, lifted altogether some 90 feet, and carried about 20 miles before reaching the farms. We therefore consider such a project entirely impracticable.

The land treatment can only be seriously thought of in connection with the sewage disposal from the smaller areas mentioned above and comprising the extreme northern and southern parts of the future metropolis. The drainage of parts of Evanston, Lake View, and Niles might be taken to the sandy ground in the latter town, and that of the Calumet region to the sandy ridges in Thornton, should this method be found most advantageous when compared with others.

The preliminary investigation made for this purpose consisted in an examination of the grounds, in the projection of a farm, and in an estimate of the cost of preparing the same and delivering the sewage to it by intercepting sewers and conduits.

DISCHARGE OF THE SEWAGE INTO THE DES PLAINES RIVER.

A third solution of the drainage problem is rendered practicable by the fact that the divide between Lake Michigan and the Mississippi valley lies about 10 miles west of Chicago, with so light an elevation that it is not a difficult matter to carry the sewage from the city westward into the Des Plaines river, and thence into the Mississippi river. The method of disposal, as previously explained, is in fact mainly the present one, most of the sewage now being carried across the divide by the Illinois and Michigan canal.

There are two low depressions between the future metropolis and the Des Plaines river—the Mud Lake valley, with the present canal, and the Sag valley, west of Lake Calumet. Neither is more than 10 feet above the lake, nor do they present any engineering difficulties for canal construction. It is therefore quite feasible to carry all the drainage from the territory ultimately to be occupied by the metropolis, extending from Lake Calumet to Evanston, into the Mississippi valley through these depressions, avoiding thereby all possible lake pollution and permitting the supply of water to be drawn from any number of convenient points in front of the city.

The possibility of this solution was recognized as early as 1856 by Mr. E. S. Chesbrough, and the first step toward its adoption was taken, as already mentioned, by turning the sewage into the Illinois and Michigan canal. Not until quite recently, however, has it become practicable to consider the construction of a special waterway for sewage removal, because when the population was smaller the expense of the undertaking was too great.

The sanitary requirements demand a flow of water large enough to dilute the sewage sufficiently to make it inoffensive along the river at all times. Beyond this, any increase in the size of the channel to provide for the storm water which naturally enters it should be kept at a minimum. A glance at the map and an examination of the ground show the possibility of diverting the greater part of the storm water from the metropolitan district without serious difficulty. Both branches of the Calumet river can be diverted west of the Indiana State line into Wolf lake, and thence into Lake Michigan. The Des Plaines river can have its flood waters diverted into the North Branch near the north line of the town of Jefferson, and the combined waters can be led from Bowmanville directly into the lake. Salt creek, a branch of the Des Plaines river, can readily be turned southwardly near Western Springs, through a watercourse known as Flag creek, at one time evidently its old bed, discharging into the Des Plaines opposite Sag, and thus reducing the necessary storm water capacity in the new channel between Sag and Summit.

In order to determine the probable quantity of flood water which can thus be excluded, it was necessary to ascertain the maximum flood discharges from all the watersheds in question. This requirement called for a gauging of Des Plaines, North Branch and Calumet rivers; a gauging of the rainfall, which is a measure of the stream flow; a survey of the watersheds and an examination of the river channels. It was also necessary to make a reconnaissance of all pos-

sible lines for diverting the Des Plaines, the North Branch, the Calumet rivers, and Salt creek, and a survey of those which were most important.

The results indicate that each one of these diversions is both practical and economical. By adopting the 'separate system' of sewerage for the territory lying north of the proposed Bowmanville channel, the surface drainage from this territory can be safely turned into the lake.

A second branch of the investigation extends to the elements governing the proper size of the waterway from which a large proportion of the storm water has been excluded. The area still draining into it will consist largely of paved streets and roofs, allowing of no absorption and shedding the water rapidly. It requires a careful consideration to determine the maximum quantity of water that may enter the proposed channel, and for which an ample allowance must be made to prevent a back flow of the polluted water to the lake.

The proper degree of sewage pollution in the new channel demanded a careful investigation. When sewage is mingled with a sufficiently large quantity of water it not only becomes inoffensive, but readily finds the oxygen which gradually purifies it. When the surface is covered with ice a greater dilution is necessary for this purpose than at other times when there is a constant replenishment of oxygen from the air. The proposed waterway should, of course, provide immunity from offence at all times.

The information upon which definitely to decide this question will be given in the final report, as the data have not yet been all collected, owing to the necessity of making actual tests of the oxidization of the canal water under the ice, which is being done for the use of the commission by Dr. J. H. Rauch, secretary of the State Board of Health. The summer conditions are presented in his late report on the water supply and sewage disposal of Chicago. The result of these analyses will be compared with those of other streams that are also polluted with sewage in order to show the rate of oxidization with varying degrees of dilution and aeration.

For the purpose of estimating the cost of the water channel we have assumed 3,600 square feet for the cross section and a velocity of the water 3 feet per second, or 2 miles per hour. This gives a discharge of 600,000 cubic feet of water per minute or 24,000 cubic feet for each 100,000 persons, which we believe equal to the maximum requirements of a population of 2,500,000 people.

A third branch of the inquiry covers the selection of routes for the proposed canals.

Between Chicago and Summit three lines are practicable—one following the west fork and Ogden ditch, and another extending from the southwestern end of the south fork in a westerly direction to the Ogden ditch, and thence to Summit, and a third being an enlargement of the present canal. We are of the opinion that eventually both the first and second of these lines should be adopted, but that the second one should be built first in order to secure circulation in the south fork. From Summit westward the bed of the river and the present canal were the only lines to be considered. The best location has not yet been finally determined.

For the drainage of the Calumet region as simple inspection shows that a canal should start from the river at the southern point of Blue Island, and extend almost directly westward to the Des Plaines valley at Sag.

A fourth branch of the inquiry relates to the study of such data as have reference to securing a proper circulation for the waterways within the city.

To throw light upon this point the variations of the lake level have been recorded since last spring by means of an automatic gauge indicating an almost continual fluctuation averaging several inches, and recurring at periods of about twenty minutes. During a low pressure of the atmosphere the amplitude of these oscillations increases, and not unfrequently reaches several

feet. The accompanying diagram (*) shows the level of the lake on August 16, 1886, at a time when an area of low barometer passed over it. From 6.40 a.m. to 6.55 a.m.—that is, in fifteen minutes—the water fell 2 feet 10 inches.

A rising level causes an inflow to the river and drives the water of the latter into the slips, where it deposits a portion of its suspended sewage matter and becomes foul. A falling level reverses the flow, and the slips empty their foul water into the river and lake. During heavy fluctuations of the latter such as the one referred to above, it has been traced more than a mile in the direction of the crib.

As the proposed canal from Bowmanville to the lake will lower the water of the North Branch at this point to the lake level, provision must be made for its circulation. The size of the Fullerton avenue conduit is not sufficient to furnish the water required for a current in both directions, nor would such arrangement be satisfactory or economical. It will be necessary to establish a flow toward the South Branch from the lake opposite Bowmanville in order to prevent a future lake pollution by the proposed channel. This can be accomplished by placing a lock in the North Branch at any point that may be found most desirable and raising the water at the same time about 1 foot. If such a lock is placed at Fullerton avenue the present pumping works, with slight modifications, can be utilized.

Finally, it must be mentioned that circulation can be secured in the proposed waterways of the Calumet region, into which the sewage is discharged, by a gravity flow from Lake Michigan into the Des Plaines valley through Lake Calumet and the Sag. The detailed features of this project have not yet been wholly matured, the estimates of cost being based on a channel having a capacity of 1,000 cubic feet per second.

COMPARISON OF PROJECTS.

In the foregoing we have outlined the main features of the only three feasible methods of disposing of the metropolitan sewage, and have given the results of the investigation reached to date. A general conclusion as to the preferable method may be given at present, and also an approximate estimate of cost. But we are not able as yet to give either conclusions or detailed statements of the probable expense regarding all parts of the proposed work, and must defer them until the final report.

In comparing the projects we will first mention their probable cost and then their relative advantages.

The discharge of the sewage into the lake from a population of 2,500,000 in the manner described above, including the extra expense, otherwise not necessary, of taking the water supply of Grosse Point, would cost at least $37,000,000, with an annual expense for interest and operation of at least $2,400,000. It would require an immediate investment of about $20,000,000.

To dispose of the entire metropolitan sewage by filtration on land would require an investment of about $58,000,000, with an annual expense of over $3,000,000 for interest, pumping and maintenance, after deducting the profit from the sale of crops. It would be necessary to invest at once about $34,000,000. Land disposal for the sewage from the Calumet region alone, with a future population of 300,000, would require an investment of about $4,000,000 and an annual expense of at least $250,000.

Finally, the cost of the Des Plaines project is approximately estimated as follows:

1. A channel from the South Fork to Joliet of the capacity heretofore given will cost between $17,000,000 and $21,000,000,

(*) Omitted; printed in House Ex. Doc. No. 264, 51st Cong., 1st sess.

2. A diversion of the flood waters of the Des Plaines to the North Branch, and Salt Creek will cost between $2,500,000 and $2,800,000.

3. Pumping works and locks for the North Branch will cost about $150,000.

4. A separate system of sewers to collect the sewage now discharged directly into the lake and to carry it into the river will cost about $600,000.

5. A channel from Lake Calumet to Sag will cost between $2,500,000 and $3,000,000.

6. A diversion of the flood waters of the Calumet river will cost between $350,000 and $400,000.

The total cost of the Des Plaines drainage project would therefore be, for the main district, between $20,250,000 and $24,550,000; for the Calumet district, between $2,850,000 and $3,400,000. The annual cost, including interest, &c., is estimated at about $1,300,000 per annum.

The pollution of the lake can be decreased and the present condition of the Chicago river, and particularly of the South Fork, can be improved by the immediate construction of the following works, which, with the exception of the pumping works at the South Fork discharging into the Illinois and Michigan canal, are all a part of the final plan.

1. Channels diverting the flood waters of the Des Plaines, North Branch, and Salt Creek, as described above.

2. A modification of the Fullerton avenue pumping station and the construction of locks for the purpose of getting circulation in the North Branch.

3. A separate system of sewers to collect the sewage now flowing into the lake from the south division and to discharge it into the South Fork.

4. A waterway extending from the western end of the South Fork to the Illinois and Michigan canal, with a new pumping station to promote circulation.

5. By raising the banks of the canal and by removing deposits this capacity can be increased 40 per cent at a small cost, and thus provide for a greater flow of water in the same.

The cost of the works comprised under these five items is estimated to be between $5,000,000 and $5,500,000. They could be finished in three years, and would greatly lessen the liability of polluting the water supply, while the sewage would be disposed of in the best practicable manner until the final completion of the Des Moines project.

It, therefore, appears that this project is decidedly the least expensive one for the present as well as for the future.

Besides the economical advantage of the Des Plaines scheme, its superiority is still further emphasized by advantages of another kind. The proposed canal will, from its necessary dimensions and its regular discharge, produce a magnificent waterway between Chicago and the Mississippi river, suitable for the navigation of boats having as much as 2,000 tons burden. It will establish an available water-power between Lockport and Marseilles fully twice as large as that of the Mississippi river at Minneapolis, which will be a great commercial value to the state. The Calumet region will be much enhanced in value by having a direct navigable channel to the Des Plaines river and by a lowering of the flood heights of the Calumet lake and river. Within the city the water of the Chicago river and its South Branch will get a much better circulation if it flows by gravity than if it has to be pumped, the necessity for which would remain even if the sewage should be discharged through intercepting sewers, either into the lake or upon land. Upon either of the latter conditions an occasional overflow from the sewers into the river during heavy rains would be more objectionable than a constant discharge of sewage into a more rapidly flowing stream. Flood waters entering the lake by way of the Chicago river would carry into it much filthy matter, either suspended or deposited, notwithstanding the existence of intercepting sewers, but the proposed diversion of such waters before reaching the populated districts will for all time obviate this un-

desirable occurrence. Lowering the level of the North Branch at Bowmanville by it, diversion to the lake will be equivalent to raising the low prairie extending toward Evanston and Niles and greatly benefit parts of these towns.

THE WATER SUPPLY.

In reaching the conclusion that the sewage of the city should be discharged into the Mississippi Valley the question of water supply is materially simplified, because the lake will then at all times furnish good water wherever intakes are desired for an extension of the works.

The preliminary inquiry made with a view to ascertain the main features of an increased supply comprised, first, a compilation of data concerning the existing works both in Chicago and its suburban towns, which were collected mainly through the courtesy of the respective authorities; and secondly, a study into the most economical method of distributing the water over the metropolitan area. The following is a brief description of the existing works:—

The present intake for the public water supply of Chicago is located in Lake Michigan about 2 miles from shore and the water is conducted to the city in two circular brick tunnels 5 and 7 feet in diameter. They extend parallel to each other under the bed of the lake, and 50 feet apart, to the north pumping works, where they are connected and where the 5-foot tunnel terminates. The 7-foot tunnel is continued under the city for a distance of 20,500 feet, to supply the west works, on Ashland avenue near Twenty-second street.

The tunnels from the source to the shore are built at a depth of 80 feet below city datum, or low water in the lake, and the 7-foot tunnel is continued on the same level for a distance of about 11,500 feet, where, to avoid rock excavation, it is inclined upward until, at the west pumping station, the top is but 21 feet below city datum. The economical capacity of the two tunnels is between 90,000,000 and 100,000,000 gallons per day, or less than the present average daily consumption of water. Their maximum capacity is reached when delivering about 150,000,000 gallons per day, which is now nearly equalled by the demand during the hours of greatest consumption, and at the present rate of increase it is estimated that during the summer of 1887 the maximum demand for water will be at the rate of 145,000,000 gallons per day; during 1888, 150,000,000 gallons per day; during 1889, 167,000,000 gallons per day; and in 1890, 180,000,000 gallons per day

To provide against accident or obstruction from ice or other cause in the main tunnels, and to provide against an adequate supply in the near future, which appeared inevitable, a new tunnel is in progress of construction. The intake is located 1,500 feet from shore, and connection is made with the other tunnels at the north pumping works.

The distribution of the water is effected by pumping it directly into the water mains at the north and west stations. At the north works the three tunnels are so arranged and constructed that any one of them can be emptied when desired for repairs or cleaning, and both the pumping stations still be supplied with water from the other tunnels. The total pumping capacity of this station is at present 67,000,000 gallons per day, but it will be increased to 91,000,000 gallons per day as soon as the new pumps now in process of erection are in operation.

The connections between the pumps, standpipes, and the distribution mains at these works have become so complex by the successive additions to the plant that an unnecssary loss of head is the consequence. As this can be remedied to some extent without great expense, we recommend that it be done at the first favourable opportunity. The station being on the shore of the lake, is not centrally located with reference to any part of the city, which renders it necessary to use a greater length of main pipe, with a consequent .loss of pressure, to reach the consumers than would otherwise be the case. The total pumping capacity

of the west side station is 60,000,000 gallons per day, and the connections between the pumps, standpipes, and mains are simple and effective, and the loss of pressure from this cause is a minimum. The location is better adapted to secure economical and satisfactory results than that of the north works, and with reference to additional pumping stations, which will later be necessary in other parts of the city, these works are well situated.

The following table compiled from the annual reports for 1884 and 1885 gives a detailed comparison of the cost of pumping at two stations, anthracite coal being used at the north side and good bituminous coal at the west side.

COST OF PUMPING 1,000,000 GALLONS 1 FOOT HIGH.

Nature of expenditure.	1884.		1885.	
	North side.	West side.	North side.	West side.
	$	$	$	$
Salaries	0·01488	0·02022	0·01560	0·01667
Fuel	·05313	·02855	·04590	·02482
Lubricants	·00064	·00186	·00057	·00160
Miscellaneous	·00323	·00417	·00133	·00401
Total	·07188	·05480	0·06340	·4710

The hydraulic methods of the system are shown on the diagram of water pressures from a survey made in December, 1886. The pressures have all been reduced to a common height above city datum and to a uniform height of water at the works. That diagram shows a greater loss of head in the vicinity of the north side station than at the west side. This is accounted for by the complex arrangements heretofore mentioned, and also by the relatively small area of mains, being only 16½ square feet at the north side and over 21 square feet at the west side. Nearly equal quantities of water are pumped at each of the stations during the middle of the day.

The following table shows the pumping capacity of all the suburban towns having a public water supply, and the pressure ordinarily maintained at the works. With the exception of South Evanston, all take water from Lake Michigan.

Locality.	Individual pump capacity.		Total pumping capacity per day.	Ordinary head at pump, in feet.
	Pumps.	Capacity per day.		
		Gallons.		
Hyde Park	2	3,000,000	.....	.....
Hyde Park	1	12,000,000	18,000,000	103 to 150
Lake	2	4,000,000	.....	.....
Lake	2	2,000,000	12,000,000	100 to 190
Lake View	1	5,000,000	.....	.....
Lake View	1	3,000,000	10,000,000	92
Lake View	1	2,000,000	.....	92
Village of Evanston	1	3,000,000	3,000,000	92
Total	11	.....	43,000,000	.....

At the artesian well supplying the village of South Evanston there is a head of about 53 feet.

The pressure at different parts of the pipe system is very irregular. In Hyde Park it varies from 165 feet at the pumps to 10 or 12 feet at Forty-third street. In the town of Lake the average head at the town hall is reported about 10 feet, with 188 feet at the pumps. In Evanston, South Evanston, and Lake View the difference of head in various parts of the villages is not very great (*).

The follwing table gives a comparison of the consumption and cost of water in Chicago and the suburban towns:—

Locality.	Year.	Average head at pumps.	Average daily pumpage.	Cost per 1,000,000 gallons delivered.	Cost of pumping 1,000,000 gallons 1 foot high.
Chicago (North side)	1885	113	38,369,134	$ 7 17	$ 0·06034
Chicago (West side)	1885	105	58,280,880	4 95	·04070
Evanston (village)	1886	113	787,000	17 00	·15000
Lake View	1886	....	1,983,000	11 85	....
Town of Lake	1886	163	7,292,023	8 80	·05400
Hyde Park	1886	....	3,410,000	8 92	....

The second point of inquiry was a study into the most economical method of distributing the water over the metropolitan area. We will at present refer to it but very briefly, mentioning only such conclusions as pertain to the immediate demands and leaving a fuller discussion of the details of this important question to the final report.

The comparatively level area upon which the city is located, and the practicability of taking the water from the lake along the city front at any desired point, after the sewage has been diverted, permits the most economical distribution to be ascertained by mathematical investigation to a much greater degree of exactness than is usually possible.

It is found to be less expensive for the densely populated areas to have pumping stations about 2 or 3 miles apart, because the loss of head and cost of mains and pumping to obtain the least allowable pressure are thus reduced to a minimum. In planning new works this fact should be considered, and locations so selected that they will be advantageous for the future as well as for the present.

The localities which we believe to be most suitable for additional pumping stations are near Twelfth street, in the central part of the city; near the Union Stock Yards; near Humboldt Park, and near Fullerton and Racine avenues.

When it is considered that at the present time the pumps are delivering during the busy part of the day at the rate of 120,000,000 gallons in twenty-four hours, which is nearly the maximum capacity of all the machinery, and that even with this large consumption of water it is impossible in some parts of the city to obtain water in the second story of the buildings, it becomes evident that an increased supply is imperatively required, and being a work of years to build new tunnels, inlets, buildings, and machinery, the necessity of deciding upon the location of the new works as soon as possible is readily seen. The locality which is suffering most from the want of water is the business section and the south part of the city, the lowest pressure extending from Twelfth street to the city limits. It will become necessary in the future to have two stations in this territory, one between Harrison and Twelfth streets and the other to be somewhere east of the Union Stock Yards. We are strongly of the opinion that of the two

(*)Here appears a 'diagram showing water pressure in the Chicago water pipes.' Not here reproduced.

stations it will be advisable and most advantageous to build the one north of Twelfth street first, for the following reasons:

1. It will require a shorter tunnel from the lake to the proposed station and less expenditure for main discharge pipes to connect with the present system than would be the case with the proposed southern station. This is equivalent to less cost and a saving of time in construction.

2. If the southern station is built first it will require mains of larger capacity leading toward the city than will be ultimately necessary when the central station is built.

3. The location recommended is near the centre of the greatest consumption of water, and will be a gain not only in obtaining greater pressure in the business district, but in removing the cause for complaint on the south side by increasing the pressure so that the water will flow to the upper floors of the highest dwellings.

4. All other parts of the city will gain by the construction in this location, as the north and west works will be relieved of the enormous drain upon them to supply water for the business part of the city. They will be better able to give a good head on the north and west sides, where the population is increasing very rapidly, and which will very soon be in the same unsatisfactory condition as now obtains in the southern end of the city, unless relief is afforded in the manner indicated.

The other pumping stations will gradually become necessary as the population increases, and for a population of 2,500,000 there will be a need for a total combined capacity of 375,000,000 gallons to provide for a daily consumption of 150 gallons per head. With several intakes and tunnels the danger from stoppage of the water supply by ice or accident will be reduced to a minimum, as it is not probable that more than one of them would be so endangered at the same time.

We believe that a submerged intake will afford a more reliable and safer structure so far as injury from passing vessels and stoppage by ice are concerned than a structure projecting above the water.

With the sewage kept out of the lake there is no need of locating the intake farther than 2 miles from the shore, where water can be obtained sufficiently free from suspended earthy matter, and where a depth of about 30 feet is generally found, which is the least depth desirable for a submerged inlet.

After presenting the results thus far gained, indicating the general solution of the Chicago drainage and water-supply problem, it remains to point out certain facts which may be useful in discussing some of the legal measures required to carry out the proposed work. We desire to state that in order to reach the best results it is imperative to have all the main drainage works, such as intercepting sewers, waterways, and pumping stations, executed and maintained under a single management. It would be economical also to design and operate the main works of supplying water to the entire metropolitan area on a uniform plan and under one management, for the same reason that it is economical to keep the north and west side pumping works under one control, thus giving facilities as far as practicable for a supply proportioned to the demand to the entire metropolitan area, including the towns not bordering on the lake. We do not wish to imply, however, that such a general authority need necessarily extend further than to the construction and maintenance of the tunnels and conduits furnishing water to the respective pumping works.

Regarding the limits for the metropolitan drainage, the investigation has shown, as already indicated, that topographical conditions clearly define two districts for the future metropolis. The main district extends from the line of Eighty-seventh street on the south to the north line of Evanston and from the lake westward to the Des Plaines river. Its sewage is collected into one channel and discharged into the Des Plaines valley at Summit. The Calumet district extends over the natural drainage area of Calumet lake and river south

of Eighty-seventh street, and has its outfall channel running from Blue Island to Sag.

The final report will contain several maps, showing certain features of the metropolitan area, namely, the distribution of the population in 1886, the existing works and main distribution pipes for water supply, and the existing main sewerage works and 5-feet contour lines over nearly the entire area. It will also contain maps and profiles of the proposed waterways and storm-water-diversion channels mentioned in the present report, and a map showing the lines of the main collecting and intercepting sewers of the proposed drainage districts, and also the lines of new tunnels and the general distribution of the water supply.

In carrying on the present investigation its various branches are placed in charge of the following gentlemen, of whose ability and industry we desire to make special mention: Mr. L. E. Cooley, principal assistant, had special charge of the hydrographic work; Mr. Charles H. Swan, of the sewage disposal on land; Mr. Francis Murphy, of the topographical work; Mr. O. Guthrie, of the river pollution, land damages, etc,. and Mr. T. T. Johnson, of the water supply, sewerage, and miscellaneous work.

Respectfully submitted.

RUDOLPH HERING,
Chief Engineer,

BENEZETT WILLIAMS,
SAMUEL G. ARTINGSTALL,
Consulting Engineers.

APPENDIX B.

CHICAGO, June 29, 1906.

DEAR GENERAL.—On May 28 I replied at length to your inquiries of May 26 concerning the final report of the drainage and water supply commission and the disposition of the materials which had been collected. Under date of May 31 you ask now for—

'The sanitary authority upon which rests the requirement of the Illinois State law that 20,000 cubic feet per minute must be diverted into the Chicago Drainage Canal for every 100,000 inhabitants.'

And again—

'How much water is really required to dilute the sewage?'

The proper answer to your questions involves a review of the considerations which determine the ratio of dilution in the sanitary district law and the justification for the same. I have therefore delayed the answer in order to consult original documents and memoranda. I have not undertaken to refer exhaustively to my records, as I am pressed for time, and my memory is entirely clear upon the essential facts.

The essence of the law is contained in sections 20 and 23 of 'An Act to create sanitary districts and to remove obstructions in the Des Plaines and Illinois rivers' (passed May 29, 1889, in force July 1, 1889). Section 20 states: 'Any channel or outlet * * * * shall be of sufficient size and capacity to produce a continuous flow of water of at least 200 cubic feet per minute for each 1,000 of the population of the district drained thereby, and the same shall be kept and maintained of such size and in such condition that the water thereof will be neither offensive nor injurious to the health of the people in this state.' Section 23 states:

'Such channel shall be made and kept of such size and in such condition that it will produce and maintain at all times a continuous flow of not less than 20,000 cubic feet of water per minute for each 100,000 of the population of such district.'

Section 23 states further : 'Such channel shall be constructed of sufficient size and capacity to produce and maintain at all times a continuous flow of not less than 300,000 cubic feet of water per minute, * * * and if any portion of any such channel shall be cut through a territory with a rocky stratum * * * such portion of said channel shall have double the flowing capacity above provided for.'

You will see that the law insists on a sanitary condition, and that the flow of water shall be continuous (at all times), and that the minimum dilution shall be (not less than) 20,000 cubic feet of water per minute for each 100,000 people. This indicates that the general assembly did not regard the ratio of dilution as a positive determination, and this accords with the facts. You will note further that the channel was to be cut through the rock with a minimum capacity of 600,000 cubic feet per minute, and that the channel in the clay was to be subject to progressive enlargement from a capacity of 300,000 cubic feet per minute with the growth of population above 1,500,000.

As a matter of fact, the rocky stratum extended from Lockport to Summit, and the channel was actually constructed of the larger capacity, leaving only 7·76 miles between Summit and the waters of the Chicago river for future enlargement. When the district was opened, January 17, 1900, the population of the district exceeded 1,500,000 and was, in fact, 1,637,972 by the federal census of 1900. By Act of the general assembly in 1903 the district was enlarged, and the population by census, within the new boundaries, was 1,775,596.

I had everything to do in determining the prime essentials of the sanitary district law above quoted. I projected the work in its substantial outlines in a report which I drafted for the committee of the Citizens' Association in September, 1885. (Ossion Guthrie, Dr. Frank Reilly, and Lyman E. Cooley were a subcommittee to examine the situation and report.) As chief-assistant to the Drainage and Water Supply Commission in 1886-87, I had charge, among other things, of the canal solution. I was consulting engineer to the State Board of Health in 1887-1889, and again in 1891, while its elaborate chemical investigation of the stream between Lake Michigan and St. Louis was under way. I was consulting engineer to the joint committee of the legislature (Mayor of Chicago, ex-officio, chairman) that framed the sanitary district Act, and as such determined the features of the law referred to. I later represented before the general assembly the several organizations of Chicago which were engaged in promoting legislation.

The state of our information in 1887 in regard to dilution and the capacity of channel required is discussed at some length in my testimony of April 7, 1887, before the joint committee of the general assembly. A few hundred copies of this were printed, but I do not know where an extra copy is to be had. I refer to this especially because it is the only published matter of that period after the preliminary report. I will also refer you to an elaborate paper which discusses the subject-matter, read on June 10, 1896, before the National Conference of State Boards of Health at Chicago. This was published by the secretary at Columbus, Ohio, and is hard to get. There were, of course, many fugitive and fragmentary discussions not considered worthy of preservation.

You will note in the preliminary report and in later testimony, that the Drainage and Water Supply Commission refers to a dilution of 24,000 cubic feet per minute as ample for a sanitary condition, and I believe that Mr. Hering, the chief of that commission, has stated that was his personal view of the requirements. As a matter of fact, the capacity of the channel was fixed at that time at 600,000 feet as required to remove the flood water from some 420 square miles of

territory (after the diversion of the upper Des Plaines river), and prevent the same from backing into the lake. The basis of population used in considering land disposal and other alternative solutions proposed was 2,500,000, and this figure was applied to the proposed channel capacity, giving the ratio of 24,000 cubic feet per minute for each 100,000 people as above stated. At that time only preliminary consideration had been given to the question of dilution, as the chief force of the investigation had been applied to other alternative solutions.

I think it is also in evidence before the joint committee of the general assembly in 1887, by Doctor Rauch, secretary of the State Board of Health, that 14,000 cubic feet per minute would be sufficient. Doctor Rauch had undertaken an investigation of the subject preliminary to the elaborate studies of 1888-89. After the adjournment of the legislature and the failure of the Hurd Bill in 1887, little further attention was given to the matter until it was taken up by the special committee appointed to frame a law and report to the next general assembly.

This committee had several hearings, and developed much diversity of opinion. Personal opinions ranged from 14,000 feet per minute to 30,000 feet, and some wished to leave the matter entirely open. As no agreement could be reached, the whole subject was referred to the consulting engineer late in 1888, and after a painstaking investigation, he reported, and the results were embodied in the draft of the Bill and subsequently became law.

The data available are referred to as follows:—

'Special investigations of the filth-producing industries of Chicago, and an elaborate investigation of the Chicago river and branches in the autumn of 1886, and after the flood of 1887, also the Illinois and Michigan canal; a careful investigation of the history and condition of sewage in the Des Plaines and Illinois rivers for the fifteen years prior to 1887, between Joliet and La Salle; the chemical investigations by the State Board of Health, over the route from Lake Michigan to the city of St. Louis, and of tributary streams, and a special investigation of the conditions produced by the distillers at Peoria and Pekin.'

The above data were probably more ample than had ever been brought before to the consideration of a similar problem. In addition, there were the following documents: Reports on the condition of the Seine at and below Paris; reports on the sewage-disposal works at Berlin, then being inaugurated; three reports by parliamentary commissions on river pollution in Great Britain; reports on pollution of streams by the State Board of Health of Massachusetts; reports by Doctor Chandler on the pollution of the Passaic river, New Jersey.

In addition, the consulting engineer had made special notes on the low water condition of the Ohio river and the of Upper Mississippi river, and on several other streams, in comparison with population.

The general result arrived at was that 14,000 cubic feet per minute would be adequate for a normal city population such as usually obtained in New England and in Europe, but that this ratio should be increased about 50 per cent on account of the special industries characteristic of Chicago and the quality of her site—flat topography, with impermeable subsoil. At that time—and we still have great industries based on animal and other organic products—the wastes coming from the stock yards and rendering establishments alone were estimated as the sewage equivalent of a normal city of 700,000 people. Every effort had been made, and is still being made, to ulitize these organic wastes, and great progress had been made in the previous twenty years, but nevertheless it was thought wise to provide sufficiently for all conditions rather than subject any industry to special burdens. These considerations raised the dilution ratio to 20,000 cubic feet per minute as a minimum, and it was so recommended.

At that time we had distilleries in Chicago which were serious offenders, but they have since closed down. I examined the distilleries at Peoria in 1891,

when 40,000 head of cattle were fed on the slops, and I found that the fish were destroyed for 24 miles down the river in the lower water season. It was noted that the conditions were worse when the raw slops were run directly into the river, as the cattle were not then present to reduce the decomposition by several stages. In this industry I understand that these wastes are now evaporated and pressed into cake and sold for stock food.

In the rendering business there is a highly concentrated effluent from the tanks, which would resemble consommé soup if it were filtered and deodorized, and this has defied all chemical science for its salvation. Hopes were entertained of converting it into commercial ammonia by destructive distillation, but this did not prove practicable on a commercial scale. I believe that some time these valuable wastes will be commercially utilized, and when this is done a great burden will be taken off the Chicago Drainage Canal. It seemed to be that if it was not possible to make an economic use of these concentrated effluents, the profitable disposal of household sewage with the enormous volumes of water used in American cities was absolutely hopeless. At that time the sentiment of sanitarians was very strongly against what we proposed as a barbarism. The experience of nearly twenty years since has fully borne out the non-economic character of sewage-disposal works, and the Chicago solution has come to be accepted as rational where the conditions permit.

I was not satisfied with our data in regard to the stock-yards district, and when chief engineer of the sanitary district in 1890 I undertook a special chemical investigation, continued over a period of time, of every outfall entering the South Fork. The work was completed, but I ceased to be chief engineer before the results were fully worked out. At the same time I made a continued series of chemical analyses of the Illinois and Michigan canal, which was then being operated to a capacity of over 50,000 cubic feet per minute. These investigations cost some $6,000. I became satisfied that I had not overestimated the special source of filth. It was my intention to carry the inquiry over the entire city and do what had never been done before—ascertain the sewage of a great municipality as a whole. If I had had my way in the matter we would have had more positive data as to the sewage equivalent and the volume of Lake Michigan water required. Our boards of trustees have not since encouraged the resumption of any such work, and indeed it has been regarded as needless by those in authority after the sanitary-district law had been passed and the work actually entered upon.

No extended investigations were again undertaken until the biological and chemical examinations of 1899 and 1900 were made by the co-operation of the health department of the city of Chicago, the Chicago University, and the University of Illinois.

This investigation was instigated by Dr. Frank W. Reilly, then and now assistant health commissioner of Chicago, after consultation with the writer. Doctor Reilly was Assistant Secretary of the State board of health during the investigations of 1881-1885, and in 1886 collated the results of Prof. J. H. Long's chemical examinations of the contents of the Illinois and Michigan canal and of the Illinois river and its tributaries as far south as Peoria. These examinations were projected by Dr. J. H. Rauch, Secretary of the State board, and were directly supervised by Doctor Reilly. His study and collation of Professor Long's analyses demonstrated that all traces of Chicago sewage population appeared in a flow of 48 miles from its source—that is between Bridgeport at the entrance of the Illinois and Mihigan canal and the town of Channahon on the Des Plaines river, after this stream has received the discharge from the canal. This demonstration completely upset the time honoured dictum of previous water analyses 'that no river on earth is long enough to purify itself after it has become contaminated with organic wastes.'

Six years later, in 1892, Pottenkofer fully corroborated Doctor Reilly's demonstration.

Doctor Reilly and myself were associated in all the early promotion of the sanitary project, and he is the only person that I know upon whom you can call for a history of the subject-matter of this letter.

The biological examinations were entirely confirmatory of the results of the investigations of 1888-89, but have the merit of less confusion in interpretation. The State board of health has since recompiled and extended the results of its steam examinations and published a report in 1903. The University of Illinois has been making for several years past a biological investigation of the waters of the Illinois river, but with no special refereuce to the matters under consideration. I do not refer to data of an ex parte character gathered in the Chicago-St. Louis suit recently decided by the United States Supreme Court.

None of this later material nor the added experieuce and reflection of nearly twenty years has changed my mind in regard to the ratio of dilution as given in 1888 and incorporated in the sanitary district law. I do not think I could make a better determination at this time. I feel bound to say, however, that we have not yet had the final demonstration of experience. We shall not positively know until the intercepting sewer system is completed and in operation, the South Fork in active circulation, and also the North Branch, so that the canal receives the entire output of the city north of Eighty-seventh street in a comparatively fresh condition. I have been apprehensive that these contributions would be made before the Chicago river sufficiently improved to furnish the necessary volume of water to promptly dilute the same. The analyses show a higher ratio per capita for chlorine and nitrogen, but this was anticipated. They also show a large proportion down the old canal, which, owing to the situation of its inlet, receives largely the output of the South Fork, but this was also anticipated. The evidence as to chlorine is to be taken with caution on account of the large use of salt in many of our industries, but the indications are that Chicago sewage may be even richer than I had presumed in comparison with the sewage of normal cities. I have no forebodings, however, other than as to the policy which may be pursued by the authorities of the sanitary district. Based on the advice of the consulting engineer the law is abundantly cautious in stating the ratio of dilution and the capacity of channel as minimums, and in insisting on a continuous flow, but unhappily there has been a disposition in many quarters to interpret these minimum requirements as maximums.

You will find in the testimony of 1887 and the paper before the National Conference of State Boards of Health in 1896, persistent reference to the necessity of maintaining the flow in the winter time. The investigations show clearly that the sewage travels farther down the stream in the winter season and is more dangerous to fish life when the oxygen cannot be renewed owing to an ice cover. The necessity for dilution is then paramount. In the original studies of an economic channel, made under my direction, first by William A. Lydon in 1886-87, and later by Thomas T. Johnston in 1890-91, the carrying capacity of a channel covered by ice was fully considered. On the present channel the capacity will be reduced by nearly 40 per cent, or to something over 60 per cent of the capacity of an open channel.

In making the studies for the main channel we adopted the most conservative coefficients. The channel depth was made nominally 22 feet, with an allowance of over 2 feet for fall between the lake and the head of the channel at Robey street, but it was understood that any proper improvement of the Chicago river and by other inlets would give a depth of 24 feet or more. The channel itself was made of better character than originally anticipated, owing to the use of the channeling machine. The effect has been to give a channel of nearly 40 per cent greater capacity than the minimum stated in the law. It

was my hope and intention to produce a channel 30 feet deep, with a capacity of 1,000,000 feet, but I was not able to reach farther than I have stated.

Under the original theory the channel is not sufficient even now to carry 600,000 feet of water per minute under an ice cover. It has been ingeniously answered that this objection could be removed by the use of ice-boats, but I have a mental resistance to all solutions of sanitary problems that are not automatic in action, for sooner or later they go awry, to the prejudice of the public health.

It is fair to say, however, that thus far little ice has formed upon the main channel and that the flow has been little interfered with from this cause. This has been attributed to the large volumes of warm water from households and from manufacturing plants, and it is supposed also that active sewage decomposition may have something to do with it, and, further, that a surface film of oleaginous matter may afford some protection. Perhaps these explanations are after the facts, and therefore speculative. Whatever may be the cause, the effects should be relatively less when the channel shall be carrying the full volume. And, again, the grand law of average will give us more severe winters than we have been having since the channel was opened.

The estimates of the carrying capacity of the main channel are based as follows (report of expert commission; see proceedings of board of trustees of sanitary district, June 19, 1901, p. 7248):

'Within the past two weeks the results of special observations made since this commission was organized, and other relevant data, has enabled an approximate determination of coefficients by which to determine the capacity of the main channel under the conditions specified. To determine these matters finally, however, requires a special set of observations under better weather conditions and with the canal operated for this purpose.'

The expert commission of 1901 estimated the capacity of the channel on a depth of 24·4 feet at Willow Springs, at 836,280 cubic feet per minute, in conjunction with a radical improvement of the Chicago river such as would furnish the entire supply of water without detriment to navigation. The same commission estimated the capacity on a depth of 24·2 feet at Willow Springs, at 827,040 cubic feet per minute in conjunction with a moderate improvement of the Chicago river north of Sixteenth street and an inlet direct to the lake adjacent to Sixteenth street on the south. In both cases the lake was assumed at Chicago datum, or low water of 1847. Both of these treatments were in harmony with the theory of the law and the original project.

The sanitary district has adopted, at least for the present, a channel through the Chicago river 300 feet wide, which the expert commission estimated would carry 390,000 feet of water per minute without detriment to navigation. I understand that it is expected to feed to the channel 600,000 feet through the Chicago river and the Thirty-ninth street conduit, and that one-fifth of this is to come by way of the conduit and the South Fork. I understand further that it is proposed to construct a channel from the Calumet region through the Sag, with a capacity of some 240,000 feet of water per minute. The total is 840,000 per minute, or the 14,000 feet per second which has been mentioned in the hearings at Washington and before your commission.

You will note in the testimony of 1887 that the consideration which originally fixed the channel at a capacity of 600,000 cubic feet per minute, was the flood volume from an area of 420 square miles. Assuming the channel to have a capacity of 840,000 cubic feet per minute, the flood equivalent would represent a territory of not over 700 square miles. To add more territory is sure to result at some time in the backing of the waters into the lake. Sewage pollution is to be regarded as most dangerous when the sewage is carried out in a fresh condition during floods and when the city is virtually taking a bath, and it was

such eruptions of flood waters from the populated area which the drainage and water supply commission sought particularly to avoid.

I am, therefore, strenuously opposed to all propositions which propose to add unlimited territory to the present channel, and which propose in any manner to sacrifice part of its capacity in the carrying of floods from upland and rural territory. All the great filth-producing industries and the great population is now tributary, and will so remain, to the Chicago river, its branches, and the main channel; and I do not think that the provision which has been made for this territory is more ample than should have been provided for reasonable future growth. The capacity on the present scale of minimum dilution, presuming it to be sufficient, is the equivalent of a population of 4,200,000. This may not actually be realized, but I feel sure that the progressive saving of wastes will eventually reduce the per capita output of sewage to more nearly the normal for other cities. We know that such utilization has already taken place in connection with the distilleries. We also have the police power, and can compel the care of specific sources of nuisance when necessity requires; but as already been remarked, such a policy in connection with our great industries has not been considered wise.

I anticipate, therefore, that as conditions develop in the future, the channel may prove sufficient for five or six millions of people provided the original plans can be carried out in their integrity. That means, however, that the capacity of the main channel shall be reserved substantially (and it has been planned and constructed on that idea) for the territory of the original district, and that only such provision shall be made for outlying territory as the actual necessities of its people require. If we study the relative growth of population and the character of the industrial development in such outlying territories, we shall be persuaded that such a policy will do no injustice and will conserve the sanitary purpose in the highest degree.

What is to be the future population of Chicago, no man can foresee. I think we may rest for the present on an assumption of five to six million people. In laying out the main channel its tangents were made parallel to and at a fixed distance from the Illinois and Michigan canal where the same was possible. The idea under this location was that the old canal would maintain the reservation for future use, and that the time might come when another canal alongside would be desirable. My thought in this matter was not so much an ultimate thought on the sanitary question as it was that we might wish to carry more water to the Illinois river in the interest of deeper navigation. If any such proposition is considered beyond the provision which has already been made, the whole continent should join, and we may dismiss it from present consideration. I do believe, however, that the time will come when public opinion on this continent will be sufficiently broad to make the best use possible of the waters of the Great Lakes, in the interest of the deepest possible navigation from the Gulf of St. Lawrence to the Gulf of Mexico, and I do believe that the project which Chicago has so happily inaugurated as the incident of a sanitary necessity, which will come to be looked upon as a monumental foresight.

I think I have covered the subject-matters of your inquiry. If you wish the documents which I have especially referred to, I will loan them to you, as I do not know where duplicates are to be had.

Yours very respectfully,

LYMAN E. COOLEY.

General O. H. Ernst,

Chairman of the American Section

International Waterways Commission, Washington, D. C.

APPENDIX C.

SUMMARY of net receipts and expenditures, sanitary district of Chicago, from organization to December 31, 1905.

Receipts.

Taxes collected for general purposes	$30,712,708 65	
Taxes collected for water-power development	2,014,730 57	
		$32,727,439 22
Bond account (bonds outstanding)—		
First issue	$ 700,000 00	
Second issue	1,200,000 00	
Third issue	1,350,000 00	
Fourth issue	1,800,000 00	
Fifth issue	1,400,000 00	
Sixth issue	440,000 00	
Seventh issue	200,000 00	
Eighth issue	190,000 00	
Ninth issue	700,000 00	
Tenth issue	750,000 00	
Eleventh issue	1,875,000 00	
Twelfth issue	1,600,000 00	
Thirteenth issue	1,275,000 00	
Fourteenth issue	1,350,000 00	
Fifteenth issue	1,350,000 00	
Sixteenth issue	2,000,000 00	
		17,180,000 00
Interest on bank balances		362,785 73
Tax levy, 1896 (warrants outstanding)		5,212 91
Dock and land improvement and rental account (rent of land)		40,123 78
American Crushed Stone Company		1,000 00
Western Stone Company		3,278 00
Total receipts		$50,319,839 64

Expenditures.

Right of way		$ 6,983,944 14
River diversion construction	$ 1,000,186 38	
Bridge construction, river diversion	142,486 20	
Main channel construction	18,547,408 95	
Bridge construction, main channel	1,978,536 38	
Controlling works, Lockport	331,253 65	
Bridge construction, controlling works	7,873 35	
Joliet project	1,309,063 46	
Bridge construction, Joliet project	271,351 16	
Chicago river, dredging, docking, &c	2,027,221 78	
Bridge construction, Chicago river	2,498,383 03	

Illinois and Michigan canal improvement at Bridgeport	$ 77,016 08		
Thirty-ninth street pumping station	211,604 85		
Improvement of Kampsville and La Grange dams	16,920 27		
Raising roadway of Brandon's bridge	5,882 68		
		$28,425,188	22
Water-power development	$ 1,346,085 92		
Bridge construction, water-power development	112,362 44		
		1,458,448	36
Capitalization and maintenance of bridges	$ 403,354 60		
Maintenance of highway bridge	12,613 89		
Maintenance account	164,775 95		
		580,744	44
Interest on bonds	$ 6,821,647 58		
Interest on tax warrants	468,453 69		
		7,290,101	27
Taxes on land—			
Cook county	$ 3,248 19		
Dupage county	1,209 07		
Will county	27,310 28		
		31,767	54
Engineering department	$ 2,064,007 21		
Engineering department, water-power development	97,778 20		
Clerical department	173,361 87		
Law department	1,031,154 12		
Treasury department	41,832 39		
Police department	400,160 69		
General account	867,944 19		
		4,685,238	67
City of Chicago		14,079	20
Land damages		76,331	84
Marine damages		9,647	32
Personal injuries account		4,087	50
Bridgeport pumping works		90,388	80
Special commission, Chicago Drainage canal		33,075	97
Telephone line		12,292	13
Telephone line repair account		104	00
Weir, McKechney & Co		22,118	14
E. D. Smith & Co		2,400	00
Total expenditures		$ 49,719,957	54
Emergency funds in hands of department officials	$ 10,400 00		
Due from F. M. Blount, treasurer (deposit in National Bank of Illinois)	22,043 48		
Due from John J. Hanberg, county collector	45,727 38		
Due from collector, town of Niles	1,660 32		
Balance in hands of C. L. Hutchinson, treasurer, December 31, 1905	520,050 92		
		599,882	10
		$ 50,319,839	64

APPENDIX D.

[Permit of July 3, 1896.]

IMPROVEMENT OF CHICAGO RIVER.

July 3, 1896.

SIR,—I have the honour to acknowledge the receipt of your letter of 16th ultimo, requesting permission to make certain changes in the capacity of the channel of the Chicago river for drainage purposes at points indicated on the map accompanying the application, and in reply beg to say that upon investigation it is found that the permission requested can be granted upon the following conditions:—

1. That while the general plan is approved, the Sanitary District of Chicago must furnish plans in triplicate on an enlarged scale showing each proposed new bridge, each by-pass, and each new dock or wharf proposed to be built, in order that the Secretary of War may act intelligently in each case.

2. That this authority shall not be interpreted as approval of the plans of the Sanitary District of Chicago to introduce a current into Chicago river. This latter proposition must hereafter be submitted for consideration.

3. That it will not cover obstructions to navigation by reason of this work while in progress or when completed.

4. That the United States shall not be put to expense by reason of this work.

5. That this authority will expire by limitation in two years from date unless extended.

Very respectfully,

JOSEPH B. DOE,

Acting Secretary of War.

B. A. ECKHART, ESQ.,

President the Sanitary District of Chicago, Rialto Building, Chicago, Ill.

[Permit of May 8, 1899.]

Whereas, by section 10 of an Act of Congress, approved March 3, 1899, entitled 'An Act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbours, and for other purposes.' it is provided that it shall not be lawful to alter or modify the course, location, condition, or capacity of the channel of any navigable water of the United States unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of War prior to beginning the same;

And whereas the sanitary district of Chicago, a municipal corporation organized under the laws of the State of Illinois, has constructed an artificial channel from Robey street, Chicago, to Lockport, and has heretofore been granted permission by the Secretary of War to make certain improvements in the Chicago river for the purpose of correcting and regulating the cross section

of the river so as to secure a flowage capacity of 300,000 cubic feet per minute with a velocity of 1¼ miles an hour, it being intended to connect the said artificial channel with the west fork of the South Branch of Chicago river at Robey street in the said city of Chicago;

And whereas the said sanitary district of Chicago has now applied to the Secretary of War for permission to divert the waters of the said Chicago river and cause them to flow into the said artificial channel at Robey street, as aforesaid;

And whereas the said sanitary district of Chicago represents that such movable dams and sluice gates as are necessary to at all times secure absolute and complete control of the volume and velocity of flow through the Chicago river have been constructed;

Now, therefore, the Chief of Engineers having consented thereto, this is to certify that the Secretary of War hereby gives permission to the said Sanitary District of Chicago to open the channel constructed and cause the waters of Chicago river to flow into the same, subject to the following conditions:

1. That it be distinctly understood that it is the intention of the Secretary of War to submit the questions connected with the work of the Sanitary District of Chicago to Congress for consideration and final action, and that this permit shall be subject to such action as may be taken by Congress.

2. That if, at any time, it become apparent that the current created by such drainage works in the south and main branches of Chicago river be unreasonably obstructive to navigation or injurious to property, the Secretary of War reserves the right to close said discharge through said channel or to modify it to such extent as may be demanded by navigation and property interests along said Chicago river and its south branch.

3. That the sanitary district of Chicago must assume all responsibility for damages to property and navigation interests by reason of the introduction of a current in Chicago river.

Witness my hand this 8th day of May, 1899.

[SEAL.]

R. A. ALGER,

Secretary of War.

JOHN M. WILSON,

Brigadier-General, Chief of Engineers, U.S. Army.

[Permit of April 9, 1901.]

Whereas, under date of May 8, 1899, the Secretary of War granted permission unto the sanitary district of Chicago to open the artificial channel from Robey Street, Chicago, to Lockport, and cause the waters of Chicago river to flow into the same, upon the following conditions, *inter alia:*

'2. That if, at any time, it become apparent that the current created by such drainage works in the south and main branches of Chicago river be unreasonably obstructive to navigation or injurious to property, the Secretary of War reserves the right to close said discharge through said channel or to modify it to such extent as may be demanded by navigation and property interests along Chicago river and its south branch;'

And whereas it is alleged by various commercial and navigation interests that the present discharge from the river into the drainage canal sometimes exceeds 300,000 cubic feet per minute, causing a velocity of nearly 3 miles per hour, which greatly endangers navigation in the present condition of the river;

Now, therefore, this is to certify that the Secretary of War, upon the recommendation of the Chief of Engineers, hereby directs said sanitary district to regulate the discharge from the river into the drainage canal so that the maximum flow through the Chicago river and its south branch shall not exceed 200,000 feet per minute.

Witness my hand this 9th day of April, 1901.

[SEAL.] ELIHU ROOT,
Secretary of War.

[Permit of July 23, 1901.]

THE SANITARY DISTRICT OF CHICAGO,
SECURITY BUILDING,
CHICAGO, July 15, 1901.

SIR,—I have the honour to request, on behalf of the sanitary district of Chicago, that your order of April 9, 1901, restricting the flow of water through the Chicago river to 200,000 cubic feet of water per minute, may be so amended as to permit the controlling works at Lockport, the outlet of the main drainage channel, to be so regulated as to permit at that point a flow of 300,000 cubic feet of water per minute between the hours of 4 p.m. and 12 o'clock midnight.

The board of trustees of the sanitary district have rigidly observed the restrictions of your order of April 9, 1901, but the result has been that the water in the main drainage channel has become greatly polluted and very offensive both to sight and smell, and is working such hardship upon the valley communities as to evoke frequent protests from various cities and municipalities along the Des Plaines and Illinois valleys.

By such a modification of your restricting order as is herein petitioned, it would be possible for the sanitary district to secure much better drainage of the city of Chicago and the purification of the waters of the Chicago river without any hardship or inconvenience whatever to the interests of navigation, as the opening of the controlling works to a flow of 300,000 cubic feet of water per minute would produce no appreciable effect upon the current of the Chicago river until three hours thereafter and would not produce the full effect until about eight hours after the opening of the gates. Therefore, by again diminishing the flow at midnight to the requirements of your order, or to 200,000 cubic feet of water per minute, the normal condition in the Chicago river would be restored before 6 a.m. on the following day and thus no hardship or inconvenience occasioned to the navigation interests of the Chicago river.

I have the honour to be, very respectfully, yours,

ALEX. J. JONES,
President.

To the Hon. ELIHU ROOT,
Secretary of War, Washington, D.C.

SESSIONAL PAPER No. 19a

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS, U.S. ARMY,

July 22, 1901.

Respectfully returned to the Secretary of War.

By an instrument, dated April 9, 1901, the Secretary of War directed the sanitary district of Chicago to regulate the discharge from the Chicago river into the drainage canal so that the maximum flow through the Chicago river and its south branch shall not exceed 200,000 feet per minute.

The sanitary district now asks that this order be so amended as to permit an increase of the flow into the canal to 300,000 cubic feet per minute between 4 p.m. and 12 midnight, daily.

It is the opinion of Major Williard, expressed in the accompanying letter of the 16th instant, that the request should be granted subject to revocation by the Secretary of War in case the increase be found dangerous to navigation.

I concur in this opinion and recommend that the order of April 9, 1901, be modified accordingly.

G. L. GILLESPIE,

Brigadier-General, Chief of Engineers, U.S. Army.

[Third indorsement.]

WAR DEPARTMENT,

July 23, 1901.

Approved as recommended by the Chief of Engineers.

E. ROOT,

Secretary of War.

[Permit of December 5, 1901.]

Whereas, under date of May 1899, the Secretary of War granted permission unto the sanitary district of Chicago to open the artificial channel from Robey street, Chicago, to Lockport, and cause the waters to flow into the same, upon the following condition *inter alia:*

'2. That if at any time it becomes apparent that the current created by such drainage work in the south and main branches of Chicago river be unreasonably obstructive to navigation or injurious to property, the Secretary of War reserves the right to close said discharge through said channel or to modify it to such extent as may be demanded by navigation and property interests along said Chicago river and its south branch.'

And whereas the Secretary of War subsequently directed said sanitary district of Chicago to regulate the discharge of water into the Chicago Drainage canal so that the maximum flow through the Chicago river shall not exceed 200,000 cubic feet per minute from midnight to 4 p. m., nor 300,000 cubic feet per minute from 4 p.m. to midnight.

And whereas said sanitary district of Chicago has applied to the Secretary of War for permission to increase the flow between midnight and 4 p.m. daily to 250,000 cubic feet per minute, and the Chief of Engineers has recommended that the increase applied for be granted, but that the rate of flow from 4 p.m. to midnight be reduced to 250,000 cubic feet per minute, so that the flow through the Chicago river shall not exceed 250,000 cubic feet per minute throughout the twenty-four hours of the day.

Now, therefore, this is to certify that, in accordance with the recommendation of the Chief of Engineers, the Secretary of War hereby gives unto said sanitary district of Chicago permission to regulate said discharge so that the maximum flow through the Chicago river shall not exceed 250,000 cubic feet per minute throughout the twenty-four hours of the day, upon the following conditions:—

1. That this permission shall be in lieu of the present authorized rates of flow as stated above.

2. That the permission herein given shall be subject to such modification as in the opinion of the Secretary of War the public interests may from time to time, require.

3. That said sanitary district of Chicago shall be responsible for all damages inflicted upon navigation interests by reason of the increase in flow herein authorized.

Witness my hand this 5th day of December, 1901.

WM. CARY SANGER,

Assistant Secretary of War.

[Permit of January 17, 1903.]

Whereas, under date of December 5, 1901, by an instrument supplementary to the original permission granted by the Secretary of War, May 8, 1899, to the sanitary district of Chicago to open the artificial channel from Robey street, Chicago, to Lockport and cause the waters of Chicago river to flow into the same, the Secretary of War, pursuant to authority reserved in said permission of May 8, 1899, gave permission to the sanitary district of Chicago to regulate said discharge so that the maximum flow through the Chicago river shall not exceed 250,000 cubic feet per minute throughout the twenty-four hours of the day, upon the following condition, *inter alia*:

'That the permission herein given shall be subject to such modification as in the opinion of the Secretary of War the public interests may from time to time require.'

And whereas the said sanitary district of Chicago has applied for permission to increase the flow through the Chicago river from 250,000 cubic feet per minute to 350,000 cubic feet per minute during the closed season of navigation, in order to carry off the accumulations of sewage deposit which line the shores along said city.

Now, therefore, this is to certify that, in accordance with the recommendation of the Chief of Engineers, the Secretary of War hereby gives unto said sanitary district of Chicago permission to increase the flow through the Chicago river from 250,000 cubic feet per minute to 350,000 cubic feet per minute until the 31st day of March, 1903, after which date it shall be reduced to 250,000 cubic feet per minute, as now authorized, upon the following conditions:—

1. That the permission herein given shall be subject to such modifications as in the opinion of the Secretary of War the public interests may from time to time require.

2. That said sanitary district of Chicago shall be responsible for all damages inflicted upon navigation interests by reason of the increase in flow herein authorized.

Witness my hand this 17th day of January, 1903.

[SEAL]. WM. CARY SANGER,

Assistant Secretary of War.

SESSIONAL PAPER No. 19a

APPENDIX E.

Resolved by the Senate, the House of Representatives concurring herein:

1. That it is the policy of the state of Illinois to procure the construction of a waterway of the greatest practicable depth and usefulness for navigation from Lake Michigan via Des Plaines and Illinois river to the Mississippi river, and to encourage the construction of feeders thereto of like proportions and usefulness.

2. That the United States is hereby requested to stop work upon the locks and dams at Lagrange and at Kampsville, and to apply all funds available and future appropriations to the improvement of the channel from Lasalle to the mouth, with a view to such a depth as will be of present utility, and in such manner as to develop progressively all the depth practicable by the aid of a large water supply from Lake Michigan at Chicago.

3. That the United States is requested to aid in the construction of a channel not less than 160 feet wide and 22 feet deep, with such a grade as to give a velocity of 3 miles per hour from Lake Michigan, at Chicago, to Lake Joliet, a pool of the Des Plaines river immediately below Joliet, and to project a channel of similar capacity and not less than 14 feet deep from Lake Joliet to Lasalle, all to be designed in such manner as to permit future development to a greater capacity.

Adopted by the Senate, May 27, 1889.

Concurred in by the House of Representatives, May 27, 1889.

APPENDIX F.

REPORT to the International Waterways Commission on the disposal of Sewage of Chicago and Vicinity, by Rudolph Hering and George W. Fuller, December 18, 1906.

NEW YORK CITY, December 18, 1906.

To the International Waterways Commission:

SIRS,—In response to your recent request we beg to report herewith upon several propositions connected with the question of extending the method of disposing of the sewage of Chicago and vicinity by means of dilution with Lake Michigan water. Your instructions may be briefly summarized as follows:—

1. Examination into the sanitary situation at Chicago so far as it is affected by sewage disposal.

2. Latest conclusions of sanitary engineers as to the amount of dilution which is required to make sewage inoffensive.

3. Is the extension of the dilution method of the outlying territory the only way to preserve the lives and health of the people of Chicago?

4. For the Calumet area, are there not other methods of sewage disposal which may be applied at a cost not exceeding much, if at all, the cost of the method of dilution proposed, and which will be equally effective in preventing the pollution of the lake waters?

5. Description of the various systems of sewage disposal which are available for the Calumet area, with a statement of their relative efficiencies.

6. Statement of the approximate relative costs of the last mentioned so far as they can be given without the preparation of detailed plans.

You further state clearly in your letter of instructions that you do not desire an investigation into the effect of the present method upon the navigation

interests of the Great Lakes, as that has already been officially considered by yourselves. Further, you state that you accept as a fixed fact the Chicago Drainage canal as designed and built, with its attendant diversion of 10,000 cubic feet per second of lake water through the Chicago river and its branches.

In accordance with further instructions we have not given consideration to questions of a legal or legislative nature. We have viewed this problem solely as an engineer proposition without regard to inter-state questions and other features associated with the fact that a portion of the future metropolitan area of Chicago will obviously lie within the state of Indiana. It is further understood that under the existing circumstances we are to give you our opinion without entering into such details as would be required by additional surveys or other field work beyond a personal inspection of the areas.

SEWAGE DISPOSAL AT CHICAGO.

Drainage canal.—Nearly all of the sewage from the population of Chicago now connected with sewers is diluted with Lake Michigan water, which, since January 17, 1900, has been allowed to flow through the new drainage canal and thus reach the valley of the Illinois river. This method of disposal is the outcome of various investigations, particularly of a commission on the drainage and water supply of Chicago in 1886-87. It was formally adopted in 1889 by state legislation, creating the 'Sanitary District of Chicago,' specifically providing that the volume of lake water for purposes of dilution shall be $3\frac{1}{3}$ cubic feet per second for each 1,000 of population connected with the sewers, or 20,000 cubic feet per minute for each 100,000 population.

Early methods.—In early days part of the sewage of Chicago flowed directly into the lake and part into the Chicago river and its branches. From the latter a portion of the water and sewage, beginning over thirty-five years ago, has been pumped at Bridgeport into the Illinois and Michigan canal, as is true to some extent to-day. It is understood that the old canal is to be discontinued by legislative action as soon as equivalent transportation and power facilities can be arranged for by means of the new canal.

Area of sanitary district.—In 1903, an Act of legislature was passed extending the area of the sanitary district from 185 to 358·1 square miles, and including the 'north shore addition' of 78·6 square miles, and the 'Calumet addition' of 94·5 square miles. The area of the city of Chicago is 190,638 square miles. leaving 167,462 square miles as the area of the present sanitary district outside the city limits.

There are several features to be noted in connection with the method of sewage disposal of the city of Chicago as adopted in 1889. It has been found to be the cheapest method then available for disposing of the sewage so that it would not pollute the public water supply, which was then and is now derived from Lake Michigan through a series of intake cribs located at various distances from shore.

Intercepting sewers.—To prevent such pollution it was of course necessary first to divert all of the sewage into the Chicago river. A pure-water commission was appointed by the mayor in 1897 to consider the question of intercepting sewers for that purpose. It recommended among others a large intercepting sewer to collect the sewage from the area along the lake front between Seventy-third and Thirty-first streets, and about a year ago a 20-foot conduit was completed on Thirty-ninth street, through which the diluted sewage from this area now passes to the south fork of the south branch of the Chicago river. At present there is a gravity flow of lake water ordinarily of about 40,000 cubic feet per minute. Pumps are now in process of erection by which ultimately there

will be pumped through this conduit about 120,000 cubic feet of lake water per minute, or 2,000 cubic feet per second.

On Twenty-second street there was formerly a main sewer draining the area bordering on the lake front between Thirty-first and Sixteenth streets, and discharging into the lake. In 1898 the flow in this sewer was reversed so that its contents now discharge into the river.

On Twelfth street, in 1898, the flow in the main sewer was also reversed.

In the heart of the city, or business section, the sewers have always discharged into the river and not into the lake. The same is true of a considerable area lying north of the Chicago river and along the lake shore. To facilitate this discharge a conduit was put in service in 1880 at Fullerton avenue, through which there has been pumped about 12,000 cubic feet of lake water per minute into the north branch of the Chicago river.

At the present time there is no sewage entering the lake between Surf street (just north of Lincoln Park) on the north side and Seventy-third street on the south side of Chicago.

Plans are under way for the construction of the necessary works to collect the sewage along the lake front between Seventy-third and Eighty-seventh streets and to pump it into sewers west of Halsted street, which lead to the Chicago river. There is very little or no sewage from this area now reaching the lake, as the district is yet practically unsewered.

On the north side there is an area between Surf street and the northern city limits and between the lake shore and the ridge between the lake and the river, which now discharges sewages into the lake, but which will be diverted next summer. This sewage is to be collected by interceptors conducting it to Lawrence avenue, where will be located a pumping station and a conduit for pumping the sewage and about 35,000 cubic feet of lake water per minute into the north branch of the Chicago river.

Farther north, at Wilmette, a conduit is proposed to be built with a pumping station near the Northern Railroad bridge in Evanston, where about 60,000 cubic feet of lake water per minute will be diverted into the north branch of the Chicago river.

Summary of flow to canal.—The projected flow of the lake water to the canal through the Chicago river and its branches to the drainage canal may therefore be divided and summarized as follows:—

——	Cubic feet, per minute.	Cubic feet, per second.
Main stream, Chicago river	373,000	6,217
Thirty-ninth street conduit	120,000	2,000
Fullerton avenue conduit	12,000	200
Lawrence avenue conduit	35,000	583
Wilmette conduit	60,000	1,000
Total	600,000	10,000

The volume for the main stream of the Chicago river as above stated is obtained by deducting the remaining quantities from the total.

REQUIREMENTS FOR THE REVERSAL OF FLOW IN THE CHICAGO RIVER.

The satisfactory disposal of the sewage of Chicago by means of the new drainage canal requires that, at and after heavy rainfalls, the storm water and sewage from the watershed of the Chicago river shall not flow into Lake Michigan,

and therefore it is necessary to secure a practical reversal of the original flow in the Chicago river.

The drainage area of the Chicago river is about 270 square miles. Flood flows in the river have reached a maximum of about 10,000 cubic feet per second, or 600,000 cubic feet per minute, and this fact was also an important element in fixing the minimum size of the present drainage canal.

As to the efficiency of arrangements for the reversal of flow, our inquiries lead us to believe that this has been accomplished in a satisfactory way. Up to the present time, and owing to the insufficient waterway of some parts of the Chicago river, the volume of Lake Michigan water going through the river has not approached the volume above stated. But there have been times when a continuous flow of the Chicago river has been towards Lake Michigan for perhaps two or three hours. This time is necessary to properly regulate the water level at the controlling works near Lockport.

POPULATION OF CHICAGO NOW SEWERING INTO THE DRAINAGE CANAL.

We find that the present population of Chicago is, in round numbers, 2,000,000 people, of which between 100,000 and 200,000 reside south of Eighty-seventh street, tributary to the Calumet district, but within the city limits. Of the remaining population about 300,000 reside in the southern lake front district. This area is tributary to the Thirty-ninth street pumping station, which, since about January 1, 1906, has brought about the diversion of the sewage from the lake into the south fork of the south branch of the Chicago river.

There is still an area in the northwestern part of the city north of Lincoln Park, spoken of as the Northern Lake Front district, which drains directly into the lake. Its population may be very roughly estimated at 70,000.

There is a considerable area south of Seventy-third street and west of Halsted street, and also a portion of the northwestern part of the city which are of a semi-suburban character. Some portions have been provided with sewers and receive the overflow from cesspools.

So far as we are able to ascertain from local officials and without making a personal canvass as to details, it appears that there are now, in round numbers, about 1,500,000 people sewering into the drainage canal. In addition to the sewage there enters it a considerable quantity of trade wastes, notably about 2,000,000 gallons from the stock-yard district, and from quite a number of other industrial establishments, such as tanneries, wool-pulling establishments, &c., as stated by the sanitary inspector in the last report of the health department.

It is our understanding that the present sewage disposal project for Chicago is not intended to provide for the disposal of trade wastes now discharged into the sewers. While comparatively little has been done as yet to remove them from the sewers, we have been informed that it is proposed to take up this matter actively.

INFLUENCE OF SEWAGE ON CHICAGO WATER SUPPLY.

The city of Chicago receives its water supply from Lake Michigan through a series of tunnels of various lengths, ranging from about 1 to 5 miles from shore. Most of them extend from the shore about 2 miles. The total pumping capacity for this supply is stated to be 529,000,000 gallons in twenty-four hours. In 1905 the average daily pumpage was recorded as 399,000,000 gallons.

Since the removal of the sewage through the drainage canal was systematically begun in January, 1900, the appearance of the water of the Chicago river has shown marked improvement.

The effect of the drainage canal upon the hygienic quality of the public water supply may be studied in connection with the typhoid fever death rates

at Chicago, which are recorded in the next table, together with corresponding death rates for a number of other American cities. It is not to be assumed that typhoid fever is entirely due to the pollution of the public water supply at Chicago or elsewhere, as it is well known that there are other means of transmitting this disease. But its relation, to the public water supply is so intimate that it gives, perhaps, the best general idea of the sanitary quality of the water, and therefore it frequently has been used as a rough means of such measurement.

There are other factors beside the drainage canal to be considered carefully in connection with the typhoid fever statistics at Chicago, and some of which should be mentioned here. Prior to 1900 there was a substantial improvement in the public water supply, partly due to the extension of some of the intake cribs and tunnels farther into the lake and partly to the reversal of the flow of a number of the sewers from the lake into the river, such as those at Twelfth and Twenty-second streets, in 1898. These are important factors in explaining the absence in the late nineties of such excessive typhoid death rates as were noted at the beginning of that decade.

Since the opening of the drainage canal typhoid fever at Chicago has been rather unusually prevalent at times. This was especially true in 1902-3, when it is understood, portions of the supply became contaminated after leaving the intake crib. These accidental pollutions have since been corrected.

The report of the city chemist of Chicago, as given in the last annual report of the department of health, shows than on an average in 1905, the city water supply was considered by him to be safe about 85 per cent of the time.

While there has been a marked improvement in recent years in the quality of the Chicago water supply, due to the progressive elimination of sewage from the lake, there is still room for more improvement. These improvements refer to the pollution along the lake front of north Lincoln Park, which is being corrected, and to the 'Calumet area' south of Eighty-seventh street, which is now under consideration.

COMPARISONS of the annual number of Recorded deaths from typhoid fever per 100,000 population at Chicago and other American cities, 1890-1905.

Year.	Chicago.	Milwaukee.	Detroit.	Cleveland.	Buffalo.	Toronto	Boston.	New York.	Philadelphia.	Baltimore.	Washington
1890	83	33	18	69	44	80	43	21	64	57	89
1891	160	33	13	50	56	90	33	22	64	34	86
1892	103	31	64	59	38	40	25	14	40	42	72
1893	42	37	29	52	37	40	26	20	40	47	72
1894	31	26	27	29	62	20	23	17	32	49	72
1895	32	25	24	35	28	30	32	17	40	28	69
1896	53	18	23	43	22	24	32	16	34	37	51
1897	29	11	15	23	19	18	33	16	33	37	42
1898	38	17	18	34	29	16	34	20	51	38	64
1899	26	17	13	32	26	19	30	16	75	30	82
1900	20	21	18	54	27	19	25	21	35	37	77
1901	29	21	20	36	27	16	25	20	33	27	67
1902	44	16	17	33	33	13	35	21	44	42	79
1903	31	17	17	114	35	15	20	18	70	36	48
1904	19	13	16	48	91	22	18	17	.....	36	43
1905	16	20	12	15	23	.....	20	16	48	36	45

LATEST CONCLUSIONS AS TO THE REQUIRED DEGREE OF DILUTION FOR THE DISPOSAL OF SEWAGE WITHOUT NUISANCE.

The disposal of sewage by dilution depends on the amount of oxygen in the diluting water being sufficient to prevent putrefaction of the organic matter in the sewage as the latter undergoes bacterial decomposition. If the oxygen is deficient, bacterial decomposition produces what is called 'putrefaction,' with its various attendant bad odours, such as noted for years in Chicago at 'Bubly creek.' If there is a sufficient amount of oxygen dissolved in the water to combine with this organic matter, decomposition goes on without any foul odours and the organic matter is reduced to inert matter in an inoffensive way.

This question is one of balancing the amount of oxygen in a given volume of water with the amount of decomposing organic matter in the sewage, which naturally must vary greatly.

There are many observations of more or less accuracy available to give figures for this relation. The Massachusetts state board of health made a special inquiry into this subject for all local rivers in 1902, with conclusions, stated on page 452 of their annual report for that year, as follows:—

'The results of the investigations show that where the quantity of water available for the dilution of the sewage in a stream exceeds about 6 cubic feet per second per 1,000 persons discharging sewage, objectionable conditions are unlikely to result from the gross pollution of all the water of a stream in dry weather. Under favourable circumstances, such as in cases where the sewage is discharged at many outlets into a large body of water, objectionable conditions may not result where the dilution is somewhat less than 6 cubic feet per second per 1,000 persons; but objectionable conditions have resulted in all of the cases thus far examined where the flow has been less than 3·5 cubic feet per second per 1,000 persons discharging sewage into the stream.'

These conclusions apply for the most part to comparatively small streams into which much manufacturing waste is discharged and upon which mill-ponds are situated.

There are times when the flow of water in the drainage canal appears to have been insufficient to eliminate objectionable odours entirely. How far this may be explained by confusion on the part of the observers of the putrefective odours, emanating from the Illinois and Michigan canal with those of the new canal, and how far it may be due to temporary reductions in the rate of flow in the new canal and river to facilitate construction work, and also to the effect of rainfalls and to old deposits in the south fork, we are unable to say.

The new canal appears to serve at present about one-half the population for which it was designed, and through it flows a volume of lake water which is variable, but which averages not far from one-half of the ultimate quantity.

It is our judgment that for large canals with the trade wastes eliminated a dilution of $3\frac{1}{3}$ cubic feet per second for each 1,000 population connected with the sewers also receiving storm water is as low a figure as it is now possible to state. Local conditions, especially temperature, which affects bacterial activities and the coefficient of absorption of oxygen by water, and still other matters, bear upon this question, the detailed discussion of which is not now necessary. We feel certain that a dilution of $2\frac{1}{2}$ cubic feet per second would cause offence at times, and probably also a dilution of 3 cubic feet per second.

FUTURE POPULATION ON AN AREA TRIBUTARY TO THE CHICAGO RIVER AND DRAINAGE CANAL WITH REFERENCE TO SEWAGE DISPOSAL.

On the basis of the diversion of 10,000 cubic feet per second of Lake Michigan water, on the present assumption of $3\frac{1}{3}$ feet per second as being the volume to be provided for each 1,000 population connected with the sewers, and

on the assumption of eliminating objectionable trade wastes, the present method of disposal may serve until the population on the drainage area of the Chicago river reaches 3,000,000 people. On the further assumption that through the Chicago river and various conduits connected with its branches there will be a flow equal to 14,000 cubic feet per second, which is the capacity of the rock section of the drainage canal, the maximum population which might be taken care of in this way is about 4,200,000 people.

With a large portion of the 270 square miles draining into the Chicago river, but not yet built up, even on a suburban basis, it is evident that in future years there will be a much greater population than now exists.

We have considered the rate of growth of Chicago from various viewpoints, notably the density of its population, and have compared its growth with that of other metropolitan districts. There is, of course, no way of predicting accurately how rapid will be the growth of Chicago in future years; but it is a reasonable assumption that before many years it will become a city of some five or six millions of population. It seems reasonable to infer that the population residing upon the area tributary to the Chicago river and its branches will ultimately exceed both the 3,000,000 and 4,200,000 estimates above mentioned. In other words, the present dilution method will certainly not alone for all time take care of the crude sewage of this area.

There are several available methods for the purification of sewage, depending upon the degree of purification desired, as will be noted beyond in connection with the Calumet area.

It is not probable that the sewage of the old part of Chicago will ever be purified by artificial means, as it would be proportionately much more difficult and expensive to deliver the sewage to suitable sites for purification than to continue the present dilution method. It is different with the outlying districts tributary to the Chicago river. In the future, when these districts become built up so that the population exceeds the limits above stated, the installation of sewage purification works will necessarily follow.

PROPOSED CALUMET CANAL.

The more essential features of this proposed canal, as obtained from local officials may be summarized as follows:—

Location.—The canal would extend from a point on the Little Calumet river, near Blue island, through the Sag valley, and enter the drainage canal near Sag station.

Territory tributary.—The total drainage area of the Calumet river is 825 square miles, of which 473 are in Indiana. Within the limits of the sanitary district of Chicago and south of Eighty-seventh street, the area is 94·5 square miles, with a population of about 1,000,000 in 1900. It is stated that the population has nearly doubled within the past six years, and it is expected to reach a million people or more within a fairly short period, as the conditions for a manufacturing district are very favourable.

Size.—The size of this canal, as proposed, is such as to give a flow of 4,000 cubic feet per second.

Reversal of flow.—The natural flow of the Calumet river exceeds 12,500 cubic feet per second. It is proposed, if suitable legislation can be secured, to construct a dam below Thorn creek, at the southern boundary of the sanitary district, and divert into Lake Michigan, through a channel to be built about 17½ miles east of the state line, the flow of this stream, with a drainage area of about 587 square miles. The size of the proposed Calumet canal is too small to secure at all times a reversal of flow of the remaining portion of the area, which is about 240 square miles. It is proposed to put a controlling lock on the canal east of

Blue island to prevent flood waters from this lower area entering the canal, at which times sewage entering the river on the lake side of the lock would go into the lake.

The proposed canal is insufficient to carry, in the future, all the storm flows of the Sag valley itself. These would, at least, in part, require diversion through present or other channels.

Cost.—The estimated cost of this proposed canal is $12,000,000.

Population to be served.—On the assumption already stated, this canal, by dilution, would dispose of the sewage of about 1,200,000 people, not including objectionable trade wastes. This makes the cost of sewage disposal $10 per capita for the entire future population, or about $60 for the present population. The sewage would for the most part reach the canal by gravity through the Calumet river, so that the cost of maintenance would be comparatively small.

In passing, we may say that the Calumet area, both in Illinois and Indiana, is certain to develop rapidly, and its population will eventually far exceed the above figure.

RELATION OF SEWAGE DISPOSAL FOR THE CALUMET AREA TO THE WATER SUPPLY OF CHICAGO.

For the reasons above stated in connection with the reversal of flow, the sanitary effect upon Lake Michigan water at the Hyde park intake and vicinity of this proposed Calumet canal would not be nearly as effective as that of the main canal for the Chicago river territory and neighbouring intakes. This fact is important in connection with the degree of sewage purification required by artificial purification works to give a sanitary effect equal to that of the proposed canal.

There seems to be no doubt that at times the sewage entering the Calumet river under present conditions from this district pollutes the lake water from the Hyde park intake crib. It may pollute the water at other intakes, but our evidence is not conclusive. In the future, when the Calumet area is built up, it is possible that intake cribs may be built nearer to the mouth of the Calumet river than is the Hyde park intake.

In view of the fact that the proposed Calumet canal can not keep all sewage out of Lake Michigan at times of heavy rainfall, it is important to note that the water supply of this section of Chicago will eventually have to be purified by modern filtration works. This can be done at moderate cost, and it will be the cheapest and best solution of this problem to filter the water supply of this district and to purify the sewage to such a degree that the effluent will be fairly clear and non-putrescible, that is, free from disagreeable odours. With additional expense the sewage effluent (of the quality just stated) can be given a supplementary purification, making it practically free of bacteria by treating it with a germicide or by filtering it according to water purification practice.

Under existing conditions we are firmly of the opinion that all the purification required of the sewage of the Calumet district is to make it fairly clear and non-putrescible.

SESSIONAL PAPER No. 19a

AVAILABLE METHODS OF SEWAGE DISPOSAL OTHER THAN THAT OF THE DILUTION METHOD PROPOSED FOR THE CALUMET AREA.

The degree of purification of sewage by various forms of treatment differs naturally under different local conditions, but from general experience approximate results may be compared, substantially as follows:—

Method.	Percentage purification.		
	Suspended matter.	Organic matter.	Bacteria.
Fine screens (30-mesh or finer)	15	10	15
Sedimentation	65	30	65
Septic treatment	65	30	65
Chemical precipitation	85	50	85
Contact filters *a*	85–90	65–70	80–85
Sprinkling filters *a*	85–90	65–70	90–95
Intermittent sand filters *a*	95–99	90–98	98–99

It is to be stated that none of the first four treatments above tabulated will by itself give a non-putrescible effluent. Therefore they can be used here only in connection with some form of filtration.

For large works, filters can be more economically operated if the sewage is first clarified in part, as stated in connection with the above summary. The most appropriate method for this preparatory or preliminary treatment is considered by most sanitary engineers in this country and abroad to consist of septic tanks, which is the expression applied to sedimentation basins in which the deposited sludge is allowed to accumulate to undergo bacterial action.

There are several forms of filters, the most widely known of which, in this country, is the intermittent sand filter, sometimes mentioned as the so-called 'land treatment' for sewage disposal. This method was considered in 1886-87 for the entire Chicago area and reported upon unfavourably on account of its being more expensive than the adopted method of dilution.

Local experience.—We find that a feeling appears to prevail among some persons at Chicago against land treatment of sewage, due perhaps to the unsuccessful operation of the sewage farm at Pullman, which is situated within this Calumet area.

We are familiar with the facts and experiences at Pullman, and are clearly of the opinion that they are not necessarily a criterion for the Calumet area. This opinion is based partly upon the small size of particles of the soil at the Pullman farm, and partly upon the fact that the farm was devoted principally to agricultural rather than sewage purification purposes.

Sand areas.—We have examined the tracts of lake sand which are found in Indiana and to a limited extent in the township of Thornton, Ill. The latter areas are too limited in extent and too shallow to be considered for present purposes. The only areas of suitable porous sand for land treatment of the Calumet sewage are in Indiana.

We have collected five samples of this sand for mechanical analysis, and have obtained the results as to size of sand grains. Representative results average substantially as follows:—

	Millimetres.
Effective size	0·15
Uniformity coefficient	1·40

(*a*) The figures for the last three forms of treatment are on the assumption that the sewage is given some form of preparatory treatment before it is applied to the filters, and that with the sprinkling filters the effluent is allowed to settle.

If we disregard the state boundary line, a large tract of sand of a suitable character is available for the disposal of the sewage of this district. The best area lies between the Little Calumet and the Grand Calumet rivers, and extends east of Hammond for many miles.

Within the past six or eight years great strides have been taken in the field of sewage purification in connection with works of wholly artificial construction. We refer particularly to filters of coarse, firm material, such as broken stone, slag or clinker, and usually spoken of as 'coarse-grained filters,' as distinguished from fine-grained sand filters.

Coarse-grained filters are of two types, spoken of as 'contact filters' and 'sprinkling filters,' according to the method by which the sewage is applied to them. These filters produce an effluent which will not putrify when they are operated at a rate far greater than that which is possible for sand filters.

We shall describe briefly each of these types of sewage-purification methods and state their approximate cost of construction on suitable sites for the Calumet area, based upon unit prices in accordance with experience elsewhere.

An outline is first required, however, of the intercepting sewers, pumping stations, and rising mains necessary to collect and deliver the sewage to the filter sites, of which there are several available.

Regardless of the particular kind of filter found most suitable for the Calumet area, there are a number of features common to all methods, and which may be stated as follows:—

Separate sewers.—With the adoption of sewage filters for this district we are clearly of the opinion that it would be advisable hereafter to build a separate system of sewers for domestic sewage only. Some, if not all, of the existing main sewers could be used for the removal of storm and surface water only, and new sewers parallel them for sewage removal; or, some of the existing sewers could be utilized for sewage removal, requiring new structures for storm-water removal. Trade wastes should be excluded from all sewers. We have obviously not included in the cost of purifying the sewage any expense for the main sewers or laterals to collect it and deliver it to the interceptors.

Volume of sewage.—We have assumed that the sewage of this district will approximate 130 gallons per capita daily on an average. With a population of 1,200,000 the total volume of sewage would therefore be about 156,000,000 gallons daily. We have also allowed for ground-water seepage up to 1,000 gallons per square mile per day.

Interceptors.—For purposes of making approximate but liberal estimates of cost of purifying the sewage of this district, we have prepared sketches showing the intercepting sewers which will be required in order to collect the sewage of the district at four or more centrally located pumping stations. We have assumed that these intercepting sewers will be built of concrete, and when flowing full, have a capacity of 250 gallons per twenty-four hours for each person resident upon the area tributary to the interceptor. When full, these interceptors have been assumed to have a velocity of 2·5 feet per second. We have also assumed, after excluding that portion of the Calumet district reached by extreme high water in the lake, that on an average the population contributing to the four or more pumping stations would be about 20 to 25 persons per acre. On this basis the length and size of the necessary intercepting sewers have been obtained.

Pumping stations.—For convenience we have located four main pumping stations near Riverdale, Harvey, South Hammond, and South Chicago. There will be required, when the district is built up to the extent herein considered, a total pumping capacity of about 340,000,000 gallons daily, including necessary reserve capacity at each station.

Septic tanks.—Regardless of the type of filter adopted, the sewage would be screened at the pumping stations, and then flow through septic tanks having a

capacity of eight hours' flow on an average. These tanks would be about 12 to 15 feet deep, built of concrete, and arranged in compartments, so as to facilitate septic action on the deposited sludge, but without such action taking place in the flowing sewage itself. Owing to the severe winter climate in this vicinity, it is our opinion that it would be wise to cover these tanks.

Of the solid matters in suspension in the sewage about 65 per cent would deposit in the septic tanks, and of these deposited solid matters about one-half would be liquified and gasified by bacterial decomposition.

The sludge, which would be removed at intervals of once a year or so from the tanks, is estimated to contain about 85 per cent water and to amount to about 2 cubic yards per 1,000,000 gallons. Bacterial action converts this sludge to a practically inert mass which can be pumped in thin layers on to adjoining land and allowed to dry.

This is the form of preliminary treatment in use in some 40 places in this country, including Plainfield, N.J., Saratoga, N.Y., Mansfield, Ohio, Champaign, Ill., &c. It is the preliminary step in the works under construction at Columbus, Ohio, after elaborate tests of different methods were made for a period of nearly one year. It has also been adopted recently at Baltimore, Md., Reading, Pa., and Waterbury, Conn., and has been recently proposed for Paterson, N.J., in a somewhat modified form.

This form of preliminary treatment has been and is now extensively used in Europe with satisfactory results where the tanks are built and operated to meet local conditions as to volume and strength of sewage.

The odours from large open septic tanks are seldom noticeable a few hundred feet away. Under good management, a septic effluent can be applied to sprinkling filters, so that no objectionable odours should be carried one-quarter of a mile.

The cost of building and operating septic tanks would be substantially the same for all filter projects, and is considered under each as a common factor.

INTERMITTENT SAND FILTERS.

This well-known method consists of applying the partially clarified sewage coming from the septic tanks to areas of porous sand below the surface of which at depths of from 3 to 5 feet are underdrains of open-jointed pipe to convey the purified sewage to the nearest water course. The sewage is applied only at intervals of once a day or so to a depth of perhaps 6 inches. Between applications the sand layer is allowed to drain so that its pores may fill with air. This aeration of the pores of the sand allows bacterial processes to convert the organic matter to a large extent to harmless mineral matter. The effluent is practically free of noticeable suspended matter and objectionable organisms and can be discharged into the nearest water course.

This method is now in sucessful use in 40 to 50 places in this country where porous sand areas are available. It serves a total population of about 350,000 people. Well-known plants are found to be at Framingham, Brocton, Clinton, and Worcester, Mass., Pawtucket and Woonsocket, R.I.; Meriden and New Britain, Conn.; Sartaoga, N.Y., &c.

From time to time it is necessary to rake, harrow, or plough the surface of intermittent sand filters and to remove the scum which slowly accumulates there. At intervals it is necessary to scrape off several inches of the upper portion of the sand layer when it is found that they are so clogged that harrowing and ploughing no longer prevents the surface from remaining covered with sewage.

With crude sewage it appears from Massachusetts evidence, especially from the tests conducted for a period of nineteen years at the Lawrence Experiment Station, that it would be necessary to provide 1 acre of intermittent sand filters

for each 500 persons connected with the sewers when the sewage is given a preliminary treatment in septic tanks and when the filters are operated under intelligent supervision the area may be reduced so as to provide 1 acre per 1,000 persons.

The most suitable natural site for sand filters for the Calumet area is to be found in the State of Indiana, between the Little Calumet and the Grand Calumet rivers, east of the city of Hammond.

It is possible to build artificial sand filters within the Calumet district, but the cost would be much greater than for any of the projects considered in this report.

Based upon our knowledge of these filters elsewhere, and without considering inter-state complications, we estimate that the cost of installing and operating such a plant, with its various appurtenances, east of Hammond, and of a capacity of about 180,000,000 gallons daily to serve a population of 1,200,000 people, would be as follows:

Estimated cost of constructing sand filter plant and appurtenances.

Intercepting sewers, pumping stations, and appurtenances, including a daily capacity of 340,000,000 gallons, and rising mains	$	5,070,000
Septic tanks, 60,000,000 gallons capacity, covered, including sludge-disposal facilities		950,000
Intermittent sand filters, 1,200 acres, with distributors, drains, office, laboratory, &c		3,600,000
	$	9,620,000
Contingencies and supervision, 15 per cent		1,443,000
Total	$	11,063,000

Annual Cost of Operation.

Pumping, fuel, labour and repairs	$	300,000
Supervision, analytical and clerical assistants, &c		25,000
Care of septic tanks, including sludge disposal		36,000
Care of sand filters		480,000
Supplies and miscellaneous		25,000
	$	866,000

Capitalizing the operating expenses at 5 per cent per annum there is obtained $17,320,000, which, when added to the estimated construction cost, makes a total sum of $28,383,000 for the sand filter project.

CONTACT FILTERS.

These filters consist of beds of broken stone, slag, or cinders, placed in uncovered basins to a depth of from 3 to 5 feet. The size of material ranges from about one-fourth to 1 inch.

The filters are ordinarily operated upon the fill and draw plan, that is, the gate on the outlet pipe is closed until the voids of the bed are filled with sewage from the septic tanks. After filling, the filters are allowed to stand

full for an hour or so, then the sewage is allowed slowly to drain out, and this cycle of operation is repeated once or twice a day.

When the filtering material is drained the voids fill with air, and it is during these periods of draining that bacterial processes accomplish the purification of the organic matter, which to a large degree is lodged upon the surfaces of the filtering material as the sewage is slowly withdrawn from the bed. The rates of filling and drawing the beds may be satisfactorily controlled by a number of automatic devices on the market and which are in successful use in a number of places.

Contact filters are an English adaptation of studies made some fifteen years ago upon the gravel filters by the Massachusetts State board of health at the Lawrence Experiment Station. These studies were begun about thirteen years ago at London. As an outcome of these and numerous other investigations, contact filters have been adopted and are in successful use for dozens of English cities, the largest of which is Manchester, with a population of about 600,000.

In this country, contact filters have been installed for a dozen or more small cities and numerous institutions. Perhaps the best known plants are at Plainfield, N. J., Mansfield, Ohio, and Charlotte, N. C. They are especially applicable to projects where only a small amount of head is available and where pumping would be required for sprinkling filters.

For large projects, and where pumping is not a factor, recent experiences with sprinkling filters show that as a rule they are more economical. Notwithstanding this, contact filters have served and will serve a useful purpose, in the field of sewage disposal in this country. These conveniences of operation make them especially suitable for small installations.

Many contact-filter plants have their beds arranged in terraces so that the sewage may be passed successively through two or three filters. There are a number of advantages of this arrangement, but it is not applicable to the Calumet district, owing to the level area of the available sites. One of the advantages of the double and triple contact filters is that they may be operated from below during winter weather and thus guard against reductions in the rate of filtration due to freezing.

The most available and suitable local sites are: A tract west of Harvey and between the Illinois Central and Rock Island railroads; a tract west of Hammond and the local branch of the Fort Wayne railroad; and a tract between Lakes Calumet and Wolf.

As to the rate of filtration, we have assumed that contact filters should be 5 feet in depth and that they would satisfactorily purify the effluent from septic tanks at the rate of 600,000 gallons per acre per twenty-four hours. This means that 1 acre of contact filters should be provided for every 4,000 persons connected with the sewers.

The effluent from contact filters operated under these conditions would be ordinarily free from objectionable amounts of suspended matter, and the amount of organic matter would be so reduced that it would not putrify upon standing. On an average about 15 to 20 per cent of the bacteria in the crude sewage would be present in the effluent. It would not be improper to discharge such an effluent as it came from the filters, directly into the nearest water course.

The amount of attendance required for contact filters it not great, and is covered mainly by the necessary gatemen, analysts, and foremen. At intervals, all the material would have to be removed from the filters, washed and replaced.

The approximate cost of building and operating a contact-filter plant with all needed appurtenances of a capacity of about 180,000,000 gallons daily to serve 1,200,000 people may be estimated as follows:—

Estimated cost of constructing contact-filter plant and appurtenances.

Intercepting sewers, pumping stations and appurtenances, including a daily capacity of 340,000,000 gallons, and rising mains	$ 3,300,000
Septic tanks, 60,000,000 gallons' capacity, covered, including sludge, disposal facilities	950,000
Contact filters, 300 acres, with all piping, appurtenances, office, laboratory, &c	6,000,000
	$10,250,000
Contingencies and supervision, 15 per cent	1,537,500
Total	$11,787,500

Annual Cost of Operations.

Pumping, fuel, labour and repairs	$200,000
Supervision, analytical and clerical assistants	30,000
Care of septic tanks, including sludge disposal	36,000
Care of contact filters	260,000
Supplies and miscellaneous	25,000
Total	$551,000

Capitalizing the operating expenses at 5 per cent per annum there is obtained $11,020,000, which when added to the estimated construction cost makes a total sum of $22,807,500 for the contact-filter project.

SPRINKLING FILTERS.

Sprinkling filters differ from contact filters principally in the method of application of sewage, which in our northern climates is discharged upon them in the form of spray from a series of fixed sprinkling nozzles placed about 12 or 25 feet apart. The filters are usually deeper and of somewhat coarser material than contact filters.

These filters also are an English adaptation of the Lawrence investigations made with gravel filters, some fifteen years ago. The English studies began at Salford in 1892 and have resulted in the adoption of this form of filter for many of the principal cities in England, the largest of which is the metropolitan district of Birmingham, with a population of over 900,000. Some of these filters have been in successful practical operation for more than eight years. On the continent, this method is being adopted for portions of the suburbs of Paris and Berlin.

In this country, this method has been studied with care at Lawrence, Mass.; Columbus, Ohio; Boston, Mass., and Waterbury, Conn. Filters of this type are now under construction at Columbus, Ohio, and Reading, Pa. They have been recently adopted for Baltimore, Md.; West Chester, Pa., Washington, Pa., and Waterbury, Conn. They have been recommended for use also at Paterson, N.J.

The important element of aeration is secured in sprinkling filters, partly by applying the liquid as a spray and partly through the use of coarse material with voids of a size so that there is a vertical circulation of air through the filtering material at all times.

Suspended mineral and organic matters and some of the dissolved organic matters are retained upon the surface of the filtering material as the liquid passes in thin films over the surface of the particles. Bacterial activities reduce the organic matter to a material degree, and from time to time the remaining inert material cracks and peels and passes through the filter bed to the bottom. In order to be able to remove this accumulated matter, it is necessary to provide false bottoms for these filters. Filters of this type have been in successful use for more than eight years without cleaning, and it is believed that under favourable conditions cleaning is not required oftener than once in ten or fifteen years.

The amount of suspended matter in the effluent of sprinkling filters due to this unloading of stored material is sufficient to require passing the effluent through settling basins, holding about two hours' flow, before discharging into the nearest water course. The settled effluent, of satisfactory appearance and with its organic matter so reduced that it will not putrefy, usually contains less than 10 per cent of the bacteria in the crude sewage.

There is a considerable range in size of broken stone and in depth of material as adopted in various large plants now built or building. Avoiding extremes, it may be stated that the depths average about 7 feet, and the size of material ranges from about 1 to 2½ inches, mean diameter. We have assumed these figures for sprinkling filters for the Calumet area, to be built of broken stone at the sites already mentioned for contact filters, namely: west of Harvey, west of Hammond, and between Lakes Calumet and Wolf.

We have carefully considered the climatic conditions at Chicago and compared them with temperatures where practical experiences with sprinkling filters have been obtained. There is no trouble from the freezing of the sprinkler nozzles through which sewage is applied under a head of 6 or 7 feet. During the zero weather some frozen sewage accumulates on the surface of the filter and at such times it is necessary to have some reserve area. We have assumed that under these local conditions one acre of sprinkling filters should be provided for every 15,000 people connected with the sewers, making a rate ordinarily of about 2,250,000 gallons per acre per twenty-four hours. As was demonstrated at Columbus, such rates for several weeks at a time may be doubled and still obtain a satisfactory non-putrescible effluent. This rate, expressed in persons served per acre-foot of sprinkling filter material, is only about one-half of that provided for at Columbus, Ohio, and one-third of that in several plants in England.

The approximate cost of building and operating a sprinkling filter plant with all needed appurtenances, of a capacity of 180,000,000 gallons daily, to serve a population of 1,200,000, may be estimated as follows:—

Estimated cost of constructing sprinkling filter plant and appurtenances.

Intercepting sewers, pumping stations and appurtenances including a daily capacity of 340,000,000 gallons, and rising mains	$3,300,000
Sceptic tanks, 60,000,000 gallons' capacity, covered, including sludge-disposal facilities	950,000
Sprinkling filters, 80 acres, with all appurtenances, office, laboratory, &c	3,600,000
Settling basins, 15,000,000 gallons' capacity	200,000
	$8,050,000
Contingencies and supervision, 15 per cent	1,207,500
Total	$9,257,500

Annual Cost of Operation.

Pumping, fuel, labour and repairs	$ 200,000
Supervision, analytical and clerical assistants	30,000
Care of septic and settling tanks, including sludge disposal	54,000
Care of sprinkling filters	110,000
Supplies and miscellaneous	25,000
Total	$419,000

Capitalizing the operating expenses at 5 per cent per annum, there is obtained $8,380,000, which when added to the estimated construction cost makes a total sum of $17,637,500 for the sprinkling filter subject.

CONCLUSION.

In recapitulating the substance of the foregoing inquiry and referring specifically to your instructions, summarized at the outset, we conclude as follows:—

1. The examination into the sanitary situation at Chicago, so far as it is affected by sewage disposal, revealed that since removing the sewage through the drainage canal the appearance of the water of the Chicago river has shown marked improvement. As regards the hygienic quality of the public water supply there has also been an improvement, due to the progressive elimination of sewage from the lake, which elimination should be completed within a few years.

2. The latest conclusions of sanitary engineers as to the amount of dilution which is required to make sewage inoffensive, are that a dilution of 3½ cubic feet per second for each 1,000 persons connected with the sewers, as provided for in the enactment of the Illinois legislature in 1889, is as low a figure as it is now possible to state. We believe that with the elimination of objectionable trade wastes and the occasional dredging of the river, this amount of dilution will be sufficient to prevent offensiveness.

3. The extension of the dilution method to the outlying territory is not the only way to preserve the lives and health of the people of Chicago. The application of this method with flows of 10,000 and 14,000 cubic feet per second, respectively, for the area tributary to the present drainage canal will serve populations not exceeding 3,000,000 and 4,200,000, respectively. For greater populations, other methods of sewage disposal will be required.

4. For the Calumet area, as well as other districts, there are several methods for the disposal of sewage, as effective as the present method of dilution in preventing the pollution of the lake waters.

5. All of these methods involve intercepting sewers and pumping stations to collect and deliver the sewage at suitable sites. Septic tanks are used for partially clarifying the sewage, which may then be applied to any one of three methods of filters, viz., intermittent sand filters, contact filters and sprinkling filters.

All of these filters, if well built and well managed, remove the suspended and organic matters so that the effluents are practically clear and are non-putrescible. The removal of bacteria by these three types of filters averages at least 98, 80, and 90 per cent, respectively. Such effluents may be discharged directly into any of the water courses of the Calumet region.

6. The approximate total costs, liberally estimated, without the preparation of detailed plans, for a population of 1,200,000, are as follows:—

A.—*Intermittent sand filters.*

Construction	$11,063,000
Annual cost of operation, $866,000, capitalized at 5 p.c.	17,320,000
	$28,383,000

B.—*Contact filters.*

Construction	$11,787,500
Annual cost of operation, $551,000, capitalized at 5 p.c.	11,020,000
	$22,807,500

C.—*Sprinkling filters.*

Construction	$ 9,257,500
Annual cost of operation, $419,000, capitalized at 5 per cent	8,380,000
	$17,637,500

The present population on the Calumet area of the sanitary district being less than 200,000 would naturally require but a portion of the cost of estimated works and of their operation to be expended at the outset.

Of the available methods of disposing of the sewage of the Calumet area, other than by dilution, the sprinkling filter method, being the cheapest, both in cost of construction and of operation, and accomplishing an adequate degree of purification, is clearly the most advantageous one.

Very respectfully,

RUDOLPH HERING,
GEORGE W. FULLER.

REPORT OF THE INTERNATIONAL WATERWAYS COMMISSION ON THE LOCATION OF THE BOUNDARY LINE BETWEEN THE UNITED STATES AND CANADA THROUGH LAKE ERIE.

TORONTO, January 4, 1907.

The Honourable the Secretary of War of the United States, and the Honourable the Minister of Public Works of the Dominion of Canada:

This matter comes before the International Waterways Commission by indorsement of the Secretary of War, dated September 10, 1906, referring letters of the Acting Secretary of State, dated September 5, 1906, and September 7, 1906, respectively. The subject-matter referred is set forth in the letter of the Acting Secretary of State, dated September 5, which, after stating that the commander of the Canadian cruiser *Vigilant* had made a proposition to log and mark by buoys the exact international water boundary line on Lake Erie, thereby enabling fishermen to keep on their side of the line, and that difference of opinion exists between interested parties as to the exact location of the boundary line, asks that the matter be referred to this commission with the inquiry whether it is known that the American and Canadian charts of the locality agree as to the distance to be logged from the gas buoys at Erie to the boundary on the usual fishing ground.

After most diligent research, the commission has been unable to discover any authoritative description, map, or chart, American or British, from which the location of the boundary line on Lake Erie can be determined and laid down on modern charts, satisfactorily, except, from a point southeast of Middle island to the mouth of Detroit river and from a point near the mouth of Niagara river, northerly.

The sixth article of the Treaty of Ghent, after stating that by the former treaty of peace, the boundary line from the point where the 45th degree of north latitude meets the St. Lawrence river, to Lake Superior, was declared to be 'along the middle of said river into Lake Ontario, through the middle of said lake, until it strikes the communication by water between that lake and Lake Erie, thence along the middle of said communication into Lake Erie, through the middle of said lake until it arrives at the water communication into the Lake Huron, thence through the middle of said lake to the water communication between that lake and Lake Superior,' and after stating that doubts have arisen as to 'what was the middle of said river, lakes and water communications, and whether certain islands lying in the same were within the dominion of His Britannic Majesty or the United States,' provides for a reference of the matter to two commissioners, who are instructed by the article to designate by a report or declaration under their hands and seals, the boundary through the said river, lakes and water communications, and to decide what islands belonged to each of the contracting parties, it being provided that the decision of the commissioners should be final and conclusive. The treaty referred to in this article is that concluded in the year 1783. By article 11 of that treaty the boundary line of the St. Lawrence system is described as commencing at a point where the 45th degree of north latitude meets the St. Lawrence river, thence through the middle of that river and through the middle of Lake Ontario, the middle of the water communication between Lake Erie and Lake Ontario, the middle of Lake Erie the middle of water communication between Lake Erie and Lake Huron, the middle of Lake Huron to the water communication between that lake and Lake Superior, thence through Lake Superior northward of the Isles Royal and Phelipeaux to the Long lake. From this it follows that the commissioners were appointed to determine the middle line of all waters between the east end of Lake Superior and the junction of the 45th degree of north latitude with the middle

line of the St. Lawrence river, in accordance with the true meaning of the Treaty of 1783.

The commissioners were appointed, and by a report, dated June 18, 1882, they described the boundary line. The description is no more definite, so far as the Great Lakes are concerned, than was the Treaty of 1783 (except in Lake Erie west of Middle Island), and a similar description to that in the treaty is adopted in the report of the commissioners when describing the boundary line in those lakes. It is impossible from the report, to lay down with accuracy the boundary line in any of the waters covered by it. The commissioners appear to have ended their labours at the foot of Neebish rapids in St. Mary's river, not agreeing as to which channel the line should follow, going north from that point. However, they filed a map showing the line from a point near the head of Sugar Island through the river to a point opposite Gros Cap and Point Iroquois, the east end of Lake Superior. In their report they state that the boundary line as determined by them 'is more clearly indicated in a series of maps accompanying their report, exhibiting a correct survey and delineation of all the rivers, lakes, water communications and islands embraced by the sixth article of the Treaty of Ghent, by a black line shaded on the British side with red and on the American side with blue, and each sheet of which series of maps is identified by a certificate subscribed by the commissioners and by the two principal surveyors employed by them.'

The commissioners, as stated in their report, prepared certain maps to accompany it, which it is understood were filed in London and in the office of the Secretary of State at Washington with quadruplicate reports. The records of the Secretary of State of Washington disclose maps, properly authenticated by the commissioners and the surveyors, showing the boundary line through the St. Lawrence river and as far as a point near and southwesterly from Duck Islands in Lake Ontario, through Niagara river to a point in the northeasterly end of Lake Erie about north of the mouth of Buffalo creek, in the city of Buffalo, from a point near, and southeasterly from Middle Island at the southwest end of Lake Erie to the mouth of the Detroit river, through the Detroit river through Lake St. Clair and the St. Clair river to Lake Huron, and through Lake Huron to and into St. Marys river as far as the foot of Neebish rapids, also from a point about a mile above Sugar Island through the river to a point opposite Point Iroquois in Lake Superior. There are on file in the office of the Secretary of State of the United States unauthenticated maps showing what purports to be the boundary line through Lakes Ontario and Erie. This commission has not had an opportunity to consult the maps filed in London by the commissioners appointed under the treaty, but historical research indicates that there was no map of the boundary line in Lake Ontario from near Duck Islands to the mouth of the Niagara river, and no map of the boundary line in Lake Erie from about opposite the city of Buffalo to a point near and southeast of Middle Island, authenticated by the commissioners appointed under the Treaty of Ghent; and it is clear that the commissioners did not agree upon the boundary line through Lake Superior, nor through the St. Marys river from the foot of Neebish rapids to a point near the head of Sugar Island. The maps of Lakes Huron, St. Clair and Superior are authenticated by the commissioners, but are so inaccurate that they are useless for the purpose of accurately determining the location of the boundary lines on them.

By the Treaty of Washington, ratified in 1842, article 11, the boundary line from the point where the commissioners under the Treaty of Ghent ceased their labours, viz., at the foot of Neebish rapids, through St. Marys river and Lake Superior to Pigeon river at the westerly end of the lake, was described. In this article, maps of St. Marys river and Lake Superior are referred to as made by the commissioners under the Treaty of Ghent, and as having traced on them part of the boundary line in St. Marys river and the boundary line in

Lake Superior to a point north of Isle Royale. These maps were made by the commissioners pursuant to article VII of the Treaty of Ghent.

Reference to the records in the office of the Secretary of State discloses maps of the boundary line described in the Treaty of Washington, certified by the commissioners appointed under the Treaty of Ghent, and by Daniel Webster, Secretary of State of the United States, and Lord Ashburton, minister plenipotentiary of Her Majesty the Queen of the United Kingdom of Great Britain and Ireland, who negotiated and signed the treaty. These maps show the boundary line from the head of Muddy lake (now know as 'Mud' lake) through the St. Marys river to a point about a mile above the head of Sugar island, and from opposite Point Iroquois through Lake Superior to the Pigeon river.

As the office of the Secretary of State of the United States is the only proper place, in the United States, for deposit of the report and maps prepared by the commissioners appointed under the provisions of the Treaty of Ghent, the commission concludes that there is no authoritative delineation of the boundary line through Lake Erie in existence unless a properly certified map was filed in London by the commissioners and is to be found there now. The commission would, however, suggest that as the dimensions of the Great Lakes and the contour of their shores had not been ascertained with any accuracy at the time the commissioners appointed under the Treaty of Ghent acted, it is highly improbable that any map prepared by them would be sufficient for the purpose of laying down the boundary line upon modern charts. The map of Lake Erie, on file in the office of the Secretary of State is an illustration; it plainly discloses that the dimensions of that lake and the contour of its shores were not known at the time it was prepared, for the lake itself appears on the map to be about eighteen miles too long, and, in one place, to be about sixteen miles wider than it actually is, with an average excess width of about six and a half miles; that is, its dimensions are so distorted that the location of the boundary line delineated upon it cannot be accurately ascertained and cannot be laid down upon modern charts without proceeding upon suppositions upon which it would be difficult or impossible to secure agreement by different engineers. The inaccuracy of this map is illustrated further hereafter.

There are in existence two official maps of Lake Erie which show a boundary line. These are, a chart prepared by the British Admiralty and a chart prepared by the Hydrographic office, Bureau of Navigation, Department of the Navy of the United States. The boundary lines as laid down upon these maps vary greatly from each other and neither one is so far authoritative as to be binding upon the United States and the Dominion of Canada. The British Admiralty map is projected upon the polyconic system, the scale being 1 to 400,000 approximately, the hydrographic chart being laid down on Mercator's projection.

The difficulty in ascertaining the exact location of the boundary on Lake Erie, from a point opposite Buffalo to the point near Middle Island, arises from the language of the Treaties of 1783 and 1814, as well as the language adopted in their report by the commissioners appointed under the latter treaty.

All these instruments define the boundary line as passing through 'the middle' of the lake. The expression used is subject to various interpretations: It may mean:—

(*a*) A line being at all points equally distant from each shore.

(*b*) A line following the general lines of the shores and dividing the surface water area as nearly as practicable into two equal parts.

(*c*) A line along the mid-channel dividing the navigable portion of the lake, and being at all points equally distant from the shoal water on each shore.

It is to be observed that if the second interpretation above mentioned be adopted as governing the location of the boundary line, a question will arise probably capable of being adjusted by compromise, as to how far the location

of the line, 'following the general lines of the shores' would be affected by the projection known as Long Point.

It is also to be observed that it may be possible to establish a line which would not greatly differ from the lines which would result from the adoption of any of the above suggested interpretations and which would consist of the fewest possible number of straight lines. The great advantage of such a boundary is manifest as enabling fishermen and navigators to locate it with accuracy.

A line can be delineated upon modern charts, by agreement between the United States and Great Britain, so as to carry out the spirit of the Treaties of 1783 and 1814, accomplish a just division of the lake and present a practical boundary consisting of a few straight lines, the location of which at any point can be accurately ascertained when necessary, and which will not be confusing to fishermen or navigators. In the opinion of the commission such a boundary is the proper one, but no engineer can project it upon modern charts until it has been settled by a joint commission, inasmuch as it is possible to place several lines upon a modern chart, differing very considerably from each other.

Accurate charts of the Great Lakes, projected on the polyconic system upon a scale of 1 to 400,000, have been issued by the United States Lake Survey, and the commission, for the purpose of illustrating the difficulties in the way of ascertaining and delineating the boundary line on Lake Erie, has caused that line as laid down by the British Admiralty, together with the line as delineated by the Hydrographic Survey Office, to be drawn on the Lake Survey chart which accompanies this report and is marked 'A.'

To illustrate the absolute unreliability and inaccuracy of the map of Lake Erie on file in the office of the Secretary of State of the United States, the commission has prepared a copy thereof upon a reduced scale, which, by superposition upon the chart marked 'A,' will disclose the distortion of the lake's dimensions and the impossibility of reproducing upon the Lake Survey chart the boundary line as it appears on that map. This reduced map accompanies our report and is marked 'B.' It is projected upon the same system and as nearly as possible upon the same scale as chart 'A.' Map 'B' discloses that at the time it was made, the contour of the south shore of Lake Erie was pretty accurately known, but that knowledge of the north shore was very general, for, by placing map 'B' on chart 'A,' the south shore-line can be made to very nearly correspond, but, this being done, the north shore-line appears greatly out of place. The southwest end of Lake Erie was surveyed by the commissioners appointed under the Treaty of Ghent and consequently approaches correctness, but the boundary line at that end of the lake as delineated on the filed map of the entire lake cannot be made to correspond with that on the certified map of the southwest end. The map of the entire lake is, in fact, utterly worthless and cannot be used for the purpose of locating the boundary on chart 'A.'

Comparison of the Hydrographic and British Admiralty boundary lines, laid down upon their respective charts as transferred to the Lake Survey chart, shows very great discrepancies; they cross and recross each other, disclosing in some places conflicting jurisdiction, and in other places what appears to be neutral territory, over which neither country would have jurisdiction. In one place, southeast of Long Point, the line on the hydrographic chart is about eight miles farther north than on the British Admiralty chart, showing conflicting jurisdiction, while at another point, southwest of Long Point, there is quite a long space between the lines, the hydrographic line being about two miles south of the British Admiralty line at the widest point, thus apparently leaving a very considerable area not within the jurisdiction of either country. If we superpose map 'B' on chart 'A,' we find still further confusion, inasmuch as the shore-line of Lake Erie as shown on map 'B' cannot be made to correspond with the shore-line on chart 'A.' No engineer is capable of reconciling these different

lines upon any theory presented by the description in the Treaty of 1783, or by the Treaty of Ghent, or by the report of the commissioners appointed under the last named treaty, as those descriptions simply place the boundary line in 'the middle' of the lake. Interpretations of these descriptions by engineers will vary in accordance with the theories which they may adopt.

All the authentic maps of the lakes and the water communications between them, and of the St. Lawrence, are subject to the general criticism, that while most of the rivers were surveyed, and an attempt was made to lay down the boundary line on them and on the lakes, the maps do not represent present conditions with sufficient accuracy to prevent serious disagreement between surveyors who might attempt to delineate the boundary line on modern and accurate charts, and the lines surveyed were not sufficiently marked.

CONCLUSION.

The commission therefore concludes:

1. That the international boundary line on Lake Erie cannot be ascertained with any accuracy from existing data.

2. That the American and Canadian charts of Lake Erie, namely, the Hydrographic and British Admiralty charts, do not agree as to the distance to be logged from the gas buoy at Erie to the boundary line on the usual fishing ground.

RECOMMENDATIONS.

The commission would respectfully recommend:

1. That the entire boundary line from the point where the 45th parallel of north latitude meets the middle of the St. Lawrence river, through that river, the Great Lakes and connecting waters, in accordance with the true intent and meaning of the Treaties of 1783, 1814 and 1842, be located to accord as nearly as possible with the lines fixed by the commissioners appointed under the Treaty of Ghent, and the Treaty of 1842, be delineated upon modern charts, and be so described by reference to fixed monuments, where necessary, that it can in the future be relocated at any given point by survey.

2. That the location, delineation on modern charts and monumenting of the boundary line, proceed under the direction of this commission or another international commission to be appointed, and that when it is located, laid down on modern charts and monumented, that it be finally fixed and determined by treaty accordingly.

3. That this commission be authorized to locate, lay down upon a modern chart and monument the boundary line through Lake Erie.

All of which is respectfully submitted.

O. H. ERNST,
Brigadier-General, U.S. Army (retired).
Chairman, American Section.

GEO. C. GIBBONS,
Chairman, Canadian Section.

GEO. CLINTON,
Member, American Section.

W. F. KING,
Member, Canadion Section.

E. E. HASKELL,
Member, American Section.

LOUIS COSTE,
Member, Canadian Section.

ATTEST:
W. E. WILSON,
Secretary, American Section.

ATTEST:
THOS. COTE,
Secretary, Canadian Section.

CANADIAN SECTION.

MEMORANDUM FOR THE DEPUTY MINISTER OF PUBLIC WORKS COVERING THE WORK OF THE INTERNATIONAL WATERWAYS COMMISSION FROM DECEMBER 31, 1906, TO JUNE 1, 1907.

A. Gobeil, Esq.,
Deputy Minister of Public Works.
Ottawa, Ont.

Ottawa, May 31, 1907.

Since the last annual report of the Canadian section has been presented to the Honourable the Minister of Public Works on Dec. 31, 1906, the commission has dealt with the question of determining the boundary line on Lake Erie, the question of the Chicago drainage canal, and the application of Mr. Smith L. Dawley, of Ogdensburg, N.Y., for permission to construct at Long Sault Island, in the township of Massena, St. Lawrence county, N.Y., dykes, retaining walls and such other structures as might be necessary to create an attractive summer resort with navigable approaches thereto and the development of a water-power.

The reports of the commission upon the Lake Erie matter and upon the Chicago drainage canal are published.

As to the application of Mr. Smith L. Dawley, the commission has disposed of it, at a meeting held in Toronto on January 4, 1907, by adopting the following resolution:—

'Whereas, Mr. Smith L. Dawley, of Ogdensburg, N.Y., submitted to the Honourable the Secretary of War of the United States, under date of May 28, 1906, an application for permission to construct at Long Sault Island, in the township of Massena, St. Lawrence county, N.Y., dykes, retaining walls and such other structures as might be necessary to create an attractive summer resort with navigable approaches thereto, and the development of a water-power entirely in that portion of the St. Lawrence river that is within the United States, which application was referred to the International Waterways Commission by indorsement of the Secretary of War, dated June 2, 1906; and,

'Whereas, the application did not furnish information sufficient to justify a recommendation in the matter, and the efforts of the commission to obtain such information from Mr. Dawley have thus far been without success;

'Whereas, the commission now learns that Mr. Dawley has transferred his rights at Long Sault Island to the Pittsburg Reduction Company, and it is the opinion of the commission that if any permit for the construction of works at this place is to be granted, it should be dealt with upon a direct application from the beneficiary; therefore be it

'Resolved, That the International Waterways Commission recommend to the Honourable the Secretary of War of the United States, that the application of Mr. Smith L. Dawley be denied.'

This resolution was based upon a report made by one of the commissioners, Dr. W. F. King, which clearly shows the position in the matter. This report is annexed, marked Appendix A.

The commission is now engaged in investigating the proposed construction of controlling works at the outlet of Lake Erie. The subject has been referred

to a committee of the commission, composed of Messrs. Louis Coste and E. E. Haskell.

The commission has also under consideration an application from the Pittsburg Reduction Company, which asks authority to construct dams, canals, power stations and locks for the improvement of navigation and development of water-power at and near Long Sault Island, St. Lawrence county, N.Y. This application is not the same as the one made by Mr. Smith L. Dawley; but it is admitted that all the chartered rights of Mr. Dawley have been transferred to or acquired by the Pittsburg Reduction Company. This is shown by the correspondence (hereto annexed, marked B) exchanged between Mr. W. Edward Wilson, Secretary of the American section and Mr. Arthur V. Davis, general manager of the Pittsburg Reduction Company. They have also acquired all the works and rights of the St. Lawrence River Power Company of Massena, N. Y. The detailed plans of the undertaking have not as yet been submitted to the commission.

In connection with this question there was introduced in the House of Representatives at Washington, on the 18th day of February, 1907, a Bill authorizing the proposed works. The Bill failed to become a law, but in anticipation of its being again presented at the next session of Congress, it was referred to the commission by the Secretary of War, on March 21, 1907. The matter was considered by the commission at its session of April 18, 1907, and a short public hearing was held. Representatives of the corporation seeking the franchise stated that no plans for the works had been prepared and asked that action by the commission be deferred until the plans could be prepared and fully explained to it. This was agreed to.

His Excellency the Governor General in Council has recently referred the following questions to the commission:—

1. The construction of a dam at the foot of Long Sault rapids in order to improve the navigation of the Rainy river;. (See Appendix C).

2. The application of the Grand Falls Power Company for permission to erect hydraulic works on the St. John river, N.B.;. (See Appendix D).

3. The matter of preventing damages caused to riparian owners by the overflowing of its banks by the Richelieu river. (See Appendix E).

The question of the approval by the Dominion Public Works Department of the compensating works constructed or to be constructed by the Michigan Lake Superior Power Company at Sault Ste. Marie, Ont., on the Canadian side of St. Marys river has also been submitted to the commission.

This question is referred to in a memorandum dated December 1, 1905, and published as appendix "Z" of the First Progress Report of the Canadian members of the commission.

The Lake Superior Power Company proceeded to build their compensating works at Sault Ste. Marie without having previously asked permission from the Dominion Department of Public Works under Chapter 92 of the Statutes of Canada of 1898, now Chapter 115 of the Revised Statutes of 1906. They had obtained on December 12, 1902, a permit from the United Sates Secretary of War to build said works, though these were to be erected on the Canadian side of Sault Ste. Marie. The permit is appended marked 'F.' In view to legalize their position, the Lake Superior Power Company presented to the Senate of Canada, a Bill giving them authority to obtain from the Governor General in Council the approval of the site and plans of the regulating works under the provisions of the 'Navigable Waters Protection Act, Chapter 115 of the Revised Statutes of 1906.' The Bill is appended marked 'G'. The Bill became law on March 14, 1907.

The Canadian members of the commission have not deemed it advisable nor necessary to make any report upon those compensating works.

The other questions mentioned above will be taken up by the commission at an early date.

Since the issue of the last annual report, which was presented to Parliament in January last, the Canadian section has held several meetings in Toronto and in Ottawa.

Dr. W. F. King, who was one of the Canadian commissioners, resigned in March last, and was succeeded by Mr. W. J. Stewart, the Dominion Hydrographer, who took his seat on the commission, for the first time, at a meeting held in Buffalo on April 18.

I have the honour to be sir,

Yours, etc.,

THOMAS COTE,

Secretary, Canadian Section.

APPENDIX "A."

REPORT upon the Application of Mr. Smith L. Dawley for the Power Works at the Long Sault Rapids.

To the Members of the

International Waterways Commission.

GENTLEMEN,—I beg to submit the following report upon the application of Mr. Smith L. Dawley for permission to construct power works at the Long Sault Rapids of the St. Lawrence river.

This matter was referred to me at the meeting of June 6 last, by a resolution which read as follows:—

'That Dr. W. F. King be instructed to ascertain the facts in regard to the application of Mr. Smith L. Dawley and to report upon the same at the next meeting of the full Commission at Buffalo on the 26th.

'Resolved further that the secretary be instructed to inform Mr. Dawley that the matter had been referred to a committee and will be taken up and disposed of at the said meeting of June 26.'

Mr. Dawley's application contained a description of the locality and general character of the proposed works, but no information as to amount of water to be taken, or power developed, except what could be gathered from the statement that the dyke would be located about 300 feet from the projecting points of the shore of the island. Accompanying the application was a chart, on which was marked the approximate position of the dykes and the dam.

I consulted with the Department of Railways and Canals at Ottawa, and visited the place with Mr. Douglas, Hydraulic Engineer of that department.

At the meeting of the 26th June, I reported to the commission what facts I had been able to gather. The effect of the report was that the data at hand were not sufficient to enable the effect of the proposed works to be ascertained, and in executive session of the commission on 27th June, it was moved by Mr. Clinton, seconded by Mr. Gibbons, and resolved

'That the matter of the application of Mr. Smith L. Dawley to the Secretary of War be referred back to Dr. King to ascertain and report upon all the facts bearing on the effect of the proposed dyke upon the interests of navigation, and upon the Canadian shore, and any other matters bearing on the subject, and that the applicant be notified that no action can be taken by the commission

until proper plans and data have been submitted showing the hydraulic conditions, the proposed works, the extent of development, estimated time for construction and the ownership of lands affected.'

After the passage of the resolution, the chairman informed Mr. Dawley of the resolution which had been passed, explaining that action must be deferred until the applicant could furnish data and plans showing the conditions of the locality, including cross sections, current velocities, material of the banks, and the work proposed to be done, giving the dimensions of the proposed dykes and a statement as to the extent including the development and estimated time to construct the works and a statement as to the ownership of lands to be affected.

At the meeting of the 24th July a blue print and a description of the proposed works was presented. I had received a copy of this blue print only the day before.

After some discussion Senator Malby was heard by the commission, which then returned to executive session, and resolved

'That the applicant be requested to furnish further plans showing the location of the proposed dyke upon an accurate map on a large scale, prepared for the purpose by actual survey, and that copy of said plans be submitted to Dr. King and to the Canadian Department of Railways and Canals with the request that the department inform the commission whether they have any objection to the proposed works in so far as they may affect the Cornwall Canal and its banks, and that Dr. King be requested to submit his report on the whole subject at the next meeting of the commission.'

No further information was furnished me by the applicant until 14th September, when Messrs. Warren and Boyer, representing Mr. Dawley, came to Ottawa.

They had with them blue prints representing the proposed dyke, &c., which they showed me.

The cross-sections, current velocities, &c., required by the commission were not shown. Except that the current in the middle of the river above the head of the rapids was stated as 3 miles per hour, and near the foot about 12 miles per hour, and that the present discharge through 300 feet of the river at a certain point was 'estimated at 792,000 cubic feet per minute,' there was so far as I could see no information other than the commission had had already. The depths in the channel seem to have been taken from the Lake Survey chart.

I explained to Messrs. Warren and Boyer the purpose of the commission in asking of them the additional information, and what surveys would be required to ascertain the effect the diversion of water would have on the levels at the head of Cornwall canal, and upon its banks.

On the following day I accompanied these gentlemen to the Department of Railways and Canals. Mr. Douglas was out of town, but we saw Mr. Butler, the Deputy Minister, who explained the view of his department as to what information should be furnished, these requirements practically coinciding with those of the commission. He stated that he considered interfering with a large river without the very fullest information with regard to volumes and currents a 'dangerous experiment.'

In this project, there are two hydraulic matters to be considered, volume of water, and direction of currents.

The volume of water now flowing opposite a certain point of the bank through the 300 feet of the proposed canal is shown on the blue print as 792,000 c.f.m. or 13,200 c. f. s. This seems to have been arrived at on the basis of 300 feet width, by 5 feet depth, and current 6 miles per hour. I understood Mr. Warren to say that the current velocity at this point had been ascertained by floating boxes, &c., down stream. The depth however does not seem to have been measured, and if not, there is a very wide possible variation in computed flow.

Assuming however that this estimate of 13,200 c.f.s. is correct, their taking this same amount by deepening to 15 feet and reducing velocity to 2 miles per hour, would have no effect upon the level of the river above at the same stage of water. Assuming that this is true at average stage of the river, the balance will be disturbed at other stages, if the same volume of water continues to be carried in the canal.

The effect will be to increase the level above at high water and to decrease the level at low water, unless with proper control, the means of effecting which have not been explained.

The total discharge of the St. Lawrence is about 250,000 c.f. s. at average stage, of which about 20 per cent must be credited to the channel south of Long Sault Island, leaving 200,000 c. f. s. in the northern channel. The proposed taking of water, 13,200 c. f. s. is about one-fifteenth of this.

The discharge it seems may vary as much as 25 per cent either way, from 150,000 c. f. s. at extreme low water to 250,000 c. f. s. at extreme high, in this northern channel.

Variation of level is most important in its effect on navigation, with regard to the level at the head of Cornwall Canal. Raising the level will do little harm, but lowering it might be disastrous.

The questions of the currents must also be considered. Apparently the current now 'throws off' somewhat at present from a projecting point of the bank about one-third of the length of the proposed canal from its head, and flows towards the opposite shore. The dyke wall projecting one-fourth of the width of the river at this point would tend to throw the current more violently against the northern bank, which is also the bank of Cornwall. The increase of the volume of the river at high water due to the cause above stated would increase this effect. The danger to the canal banks from ice running in the spring would probably be greatly increased.

Since the 15th September, I have received no further information from Mr. Dawley.

Respectfully submitted,

OTTAWA, ONT., Dec. 16, 1906. W. F. KING

APPENDIX B.

Mr. SMITH L. DAWLEY, November 28, 1906.

ODGENSBURG, N.Y.

Dear Sir:—The International Waterways Commission has instructed me to notify you that the following action has been taken upon your application.

That unless the plans which Mr. Dawley was requested to present are presented by January 1, 1907, the commission will report adversely to his application. The plans mentioned above are described in the resolutions passed at the July meeting of the commission, held at Toronto, Ontario, which are as follows:—

'Resolved: That the applicant be requested to furnish plans showing the location of the proposed dykes upon an accurate map on large scale prepared for the purpose by actual survey and that copy of said plans be submitted to Dr. King and to the Department of Railways and Canals with the request that the department inform the commission whether they have any objection to the proposed works in so far as they may affect the Cornwall Canal and its banks.'

Very truly yours,

(Signed) W. E. WILSON,

Secretary, American Section.

THE PITTSBURG REDUCTION COMPANY, Manufacturers of ALUMINIUM.

PITTSBURGH, PA., U.S., December 18, 1906.

Mr. W. EDWARD WILSON,
Sec. American Section International Waterways Commission,
328 Federal Building, Buffalo, N.Y.

Dear SIR,—Your letter of November 28 to Mr. Smith L. Dawley has been forwarded to me by Mr. Dawley under date of December 5. The letter however, arrived in my absence, so I have not been able to reply to it until to-day.

I am quite sure that you understand our attitude in connection with the Dawley scheme so well that I need hardly explain to you our position regarding maps, surveys, etc., when we arranged with the Dawley syndicate they turned over to us all the maps and drawings that they had, and these I think you saw at Massena. I was under the impression that we had the drawings here and that only blue prints were at Massena, but I can find no drawings at all so that I am inclined to think that everything is at Massena. I am not able therefore to state specifically just what we have although I have telegraphed to Massena to send everything here. However, there is no doubt but that the plan which we had with us on Long Island, which showed the dyke and which also showed surveying points, stakes for which we saw, as you will remember, is practically the only drawings that the Dawley syndicate had which would be of interest to the International Waterways Commission. Mr. Dawley states in his letter that this blue print was made from actual survey. Their other drawings were proposed plans of a power-house.

The question therefore is whether the blue print plan which you saw, a copy of which I will send you immediately (although I believe you already have a copy forwarded to you from Massena) is sufficient for the International Waterways Commission? If it is not, we would then have to make an engineering survey of the whole proposition, which would take some little time and which would be very difficult to make at this season of the year. I have just returned from Massena; it is twenty degrees below zero and the ground was covered with snow.

You are familiar with our situation and our plans that I am venturing, and I trust properly so, to ask if you will not advise me how we ought to proceed, so far as you can consistently do so.

We naturally would not want the International Waterways Commission to reject the application, even though the objection might be based on the technicality that drawings had not been furnished. It would at least be something to be explained away at any future time, and if the commission desires such drawings, rather than to have the application rejected for this reason we would make plans just as soon as we possibly could.

On the other hand until we have perfected our general scheme we do not know whether we would want to develop the Dawley scheme even if we could. We will know about this in a few months. If it were possible to let the matter simply remain in abeyance until we have made our own plans and have informed the commission what these plans are, it would naturally suit us better, but of course we desire to conform to the wishes of the commission and yourself.

I trust I am not putting you in an embarrassing position by writing this letter, and desire to state that of course it is not personal in the way that we would not be very glad to have it laid before the commission if you would think proper.

Yours very truly,

THE PITTSBURGH REDUCTION CO.

ARTHUR V. DAVIS, *Gen'l. Mgr.*

THE PITTSBURGH REDUCTION CO.

PITTSBURG, PA., December 29, 1906.

Mr. W. EDWARD WILSON,

Secretary, American Section, International Waterways Commission,

328 Federal Bldg., Buffalo, N.Y.

Dear SIR,—Your letter of November 28, to Mr. Smith L. Dawley has been forwarded to us by Mr. Dawley and we note that the commission desire more accurate plans and further data. We would respectfully request that action on the application of Mr. Smith L. Dawley be deferred for a few months until the project can be fully investigated and further data can be gathered.

We only recently acquired the land and rights connected with this application, formerly held by Smith L. Dawley and his associates, and it is impossible at this season of the year to make the surveys, soundings, etc., necessary to get the information desired by the commission.

Trusting that the commission will be willing to defer action on this application until we are able to get the required information, we remain,

Yours very truly,

THE PITTSBURG REDUCTION CO.

ARTHUR V. DAVIS, *Gen'l. Mgr.*

APPENDIX 'C'.

No. 303673.
Subj. 13.

EXTRACT from a report of the Committee of the Privy Council, approved by the Governor General on the 6th May, 1907.

On a memorandum dated 2nd May, 1907, from the Acting Minister of Public Works, stating that in order to improve the navigation of the Rainy river, a navigable stream forming part of the boundary between the province of Ontario and the State of Minnesota, in which the existence of two rapids render the navigation difficult and dangerous, the Chief Engineer of the Department of Public Works was requested to cause an examination and report to be made.

In this report Mr. J. W. Fraser, strongly recommends the construction of a dam at the foot of Long Sault Rapids, a section of which will abut on American territory. This dam built of timber, would raise the water to a sufficient height to obliterate both Manitou and Long Sault Rapids which interrupt the navigation of the river about the middle of its course.

The Minister further states that Parliament at its last session provided an amount of $50,000 towards the commencement of this work.

The Minister, in view of the Rainy river being an international stream, recommends that before any action is taken the question of its improvements be submitted to the International Waterways Commission for consideration and report.

The Committee submit the same for approval.

(Sgd.) RODOLPHE BOUDREAU,
Clerk of the Privy Council.

The Honourable
The Minister of Public Works.

APPENDIX D.

EXTRACT from a Report of the Committee of the Privy Council, approved by the Governor General on the 9th May, 1907.

On a memorandum, dated 7th May, 1907, from the Acting Minister of Public Works submitting that the Grand Falls Power Company, Limited, was chartered by an Act of the Provincial Government of New Brunswick, 5 Edward VII, in 1905, the company subsequently applying to the Governor General in Council on the 5th January, 1906, for permission to construct hydraulic works on the River St. John.

To this application, however, strong protests were opposed:—

Firstly—by the Madawaska Log Driving Company and the St. John River Log Driving Company, largely interested in the navigation of that stream at that special point and largely controlling the log driving operations on the river. The objections of the said log driving companies are given in detail more particularly in paragraph 3 of Mr. Resident Engineer Shewen's report and in the different documents attached hereto, and from which copies it will also be seen that an agreement was finally arrived at between the said log driving corporations and the Grand Falls Power Company.

The Canadian Pacific Railway Company also objected to the granting of the permission sought for by the applicants, for the reason that the raising of the water near their bridge at that place will render the repairs to that structure very difficult and much more expensive.

Lastly—the Grand Falls Water Power and Boom Company, incorporated by Chapter 77 of the Acts of the Dominion of Canada passed on the 22nd July, 1895, claim they have acquired lands, mill privileges, water-power, right of flowage, etc., and that the construction of the work proposed by the Grand Falls Power Company, Limited, will practically destroy their privileges.

The River St. John being a boundary stream, works affecting its navigation are of international importance, and for that reason would come more properly under the jurisdiction of the International Deep Waterways Commission.

The Minister, therefore, recommends that authority be given to refer the application of the Grand Falls Power Company, Limited, and of the protests lodged against said applications to the International Deep Waterways Commission, for their examination and report.

The Committee submit the same for approval.

(Signed) F. K. BENNETS,

Asst. Clerk of the Privy Council.

The Honourable,

The Minister of Public Works.

THE APPLICATION OF THE GRAND FALLS POWER COMPANY.

PRIVY COUNCIL, CANADA.

To His Excellency the Right Honourable Sir Albert Henry George, Earl Grey, Viscount Howick, Baron Grey of Howick, in the County of Northumberland in the Peerage of the United Kingdom and a Baronet; Knight Grand Cross of the Most Distinguished Order of Saint Michael and Saint George, etc., etc., Governor General of Canada, in Council.

The memorial of the Grand Falls Power Company, Limited, a corporation duly incorporated by letters patent issued under and by virtue of an Act of the

Legislative Assembly of the province of New Brunswick, 3 Edward VII, Chapter 3, confirmed by an Act of said Legislative Assembly 5 Edward VII, Chapter 17, humbly showeth:—

1. That your memorialist company was duly incorporated under and by virtue of letters patent issued and confirmed as above stated for the purpose *inter alia* of developing the water-power at the Grand Falls on the River Saint John in the county of Victoria, and province of New Brunswick, with power to build dams, hydraulic raceways, conduits and other works as might be necessary for the development of such power and the operations of the company.

2. That your memorialist company has prepared plans of the dam and other works which it proposes to build in the River Saint John, at the Grand Falls aforesaid and has deposited such plans and a description of the proposed site of said dam and works with the Minister of Public Works of Canada and a duplicate of each in the office of the Registrar of Deeds for the county of Victoria in the province of New Brunswick in which county such work is proposed to be constructed, and also proposes to give one month's notice of the said deposit of such plans and of this application by advertisement in the *Canada Gazette* and in two newspapers published in or near the locality where such dam and other works are to be constructed to wit, in the *Victoria County News*, a newspaper printed and published at Grand Falls aforesaid and in the *Carleton Sentinel*, a newspaper printed and published at Woodstock, in the county of Carleton in said province.

Your memorialist company therefore humbly prays that the said plans and description of the proposed site of the said dam and works may be approved by Your Excellency in Council as provided by section 5 of chapter 92 of the Revised Statutes of Canada intituled 'An Act respecting certain works constructed in navigable waters.'

And as in duty bound will ever pray.

Dated the fifth day of January, A.D. 1906.

The Grand Falls Power Company, Limited.

By (sgd) BARTON E. KINGMAN, *President.*

And (sgd) HARRY McLAUGHLIN, *Secretary.*

DESCRIPTION OF WATER-POWER DEVELOPMENT AND OF THE PROPOSED WORKS AT GRAND FALLS, N.B.

The Grand Falls Power Company, Limited, of Grand Falls, N.B., with head office at No. 542 Fifth Avenue, New York, propose to develop the water power of the St. John river at Grand Falls for the purpose of generating electrical power by constructing the necessary works consisting of a dam, forebay, gate-house, conduit, power-house and tail-race.

The dam, forebay, gate-house and entrance to the conduits will be located at the Upper Basin above the falls while the power house and tail-race will be on the Lower Basin below the falls, as shown on the map of Grand Falls, drawing No. 12-A.

It is proposed to conduct the water from the forebay to the power-house by reinforced concrete conduits and concrete tunnels under the ridge separating the Upper Basin of the river from the Lower Basin, and from the end of the tunnels to the power house by steel feeder pipes.

DAM.

The dam will be located about 750 feet above the falls across a narrow portion of the river. It is to be built of concrete with rubble displacers. It

will be about 28 feet high in the deepest section of the channel of the river and 540 feet long on the over-flow between abutments. The crest of the dam will be at elevation 232·00 or about 14 feet above the present normal surface of the river. The upstream face will be perpendicular to a point 12 inches below the crest where it slopes towards the crest which is formed by a rounding face descending on the downstream side at an angle of 30 degrees and then curved at a radius of 10 feet at the apron which is at elevation 222·00, ten feet below the crest of the dam. This shape of face discharges the water in an unbroken sheet and throws it a safe distance from the toe of the dam thus preventing erosion of the river bed near the dam; also floating objects such as ice or logs find an easy passage over this shape of dam.

The dam is to be founded on solid rock bed which is to be prepared by thoroughly cleaning out all loose rocks, soft or disintegrated rock and the bed rock must then be roughened up to a depth of a foot at least, affording a clean troughed surface for the concrete to adhere to, all loose material being removed before depositing concrete.

The concrete will be of a proportion of about one part Portland cement, 3½ parts of clean sharp sand and 5½ parts of broken stone that will pass a ring two inches in diameter. The Portland cement used in all the work to be subject to rigid inspection as to strength, and must have a minimum tensile strength of 550 pounds per square inch for neat cement after setting seven days.

The abutment at the north end of the dam will be a high concrete retaining wall with wing walls built back into the bank at an angle of 30 degrees and filled in with earth. The top of the abutment walls will be elevation 248·00, sixteen feet above the crest of the dam, or four feet more than any recorded rise in the river.

At the south end of the dam will be built a concrete forebay, having a 10 feet diameter feeder pipe built into the forebay wall.

The forebay will be provided with the necessary screening racks and head gates and will be covered by a gate house built of wood or concrete 20′ 0″ by 29′ 6″.

Between the forebay and bank there will be an abutment formed by concrete retaining walls on upstream and downstream sides and filled with earth.

The top of the abutment and floor of gate-house will be at elevation 248·00.

The dam at its highest section is calculated to have a factor of safety of 3·2 against overturning if the water stands at the crest of the dam on the pond side and is entirely drained away on the downstream side. In the shallower portions of the stream this said factor will be from 6 to 8, taking the concrete to weigh 145 lbs. per cubic foot. This is considered to be the greatest pressure since, with a flood pouring over the dam, the channel below would become filled and the backwater would not allow as great a pressure head for the dam to resist.

FOREBAY AND GATE-HOUSE.

The forebay and gate-house are located in the cove of the Upper Basin near the portage road, about 800 feet above the site of the dam or 1,500 feet above the falls.

The forebay and entrance to the water conduits are built of concrete and covered by a reinforced concrete gate-house 25 feet wide by 211′ 6″ long. The curtain wall of the forebay will be reinforced by steel rods as will the floor of the gate-house and the end walls of the forebay. It is proposed to build the gate-house of concrete building blocks with a reinforced concrete roof.

The forebay wall is a massive concrete wall pierced by the divergent entrance to the conduits. The forebay will be provided with the necessary steel screening racks, head gates and power gate hoists. There will be seven conduits leading from the forebay built of concrete amply reinforced by steel rods

These conduits converge and enter the hillside close together. The top of the underground tunnel will be from 80 to 100 feet beneath the town.

Between the forebay wall and the hillside will be filled in with the excavation from the tunnelling to an elevation 247·00 fifteen feet above the crest of the dam.

LOG TUNNEL.

It is proposed to construct a tunnel for the passage of logs from the Upper to the Lower Bay, said tunnel being located about directly under and in line with Pleasant Street of the town of Grand Falls.

The bottom of said tunnel will be at about three feet below the elevation of the crest of the dam and sloping gradually at a slope of about one in twenty towards the Lower Basin where it discharges at an elevation of about sixteen feet above the normal stage of the river.

Said tunnel will have a cross section of seven feet in height and six feet in width, lined with Portland cement concrete 12 inches thick.

The entrance of said tunnel will be provided with a submerged movable gate slide that will move the gate as it is raised or lowered and said gate to be operated by a hoisting mechanism that can be operated easily by two men. The walls forming said entrance will be constructed of Portland cement concrete, and made diverging to give an easy entrance for logs.

Said tunnel will pass a log 50 feet long and 4 feet in diameter.

From the entrance of the log tunnel there will be a log boom extended diagonally upstream across the river to guide all logs towards the tunnel. Said boom to be constructed of 5-12″ x 14″ timbers securely bolted to gether and held in place by steel wire cables attached to bottom of boom and anchored on the opposite shore.

This boom, being located in the pond above the dam which sets still water back for a distance of about 12 miles, will also provide a large storage for logs, if for any reason the passage of logs was stopped for a time through the tunnel, and the velocity of the water in the pond due to the increased cross-section, being less than two feet per second, the liability of logs to dive under the boom is not appreciable.

THE PROTESTS AGAINST THE PROPOSED WORKS OF THE GRAND FALLS POWER COMPANY.

To His Honour, The Lieutenant Governor, and the Members of the Executive Council, of the Province of New Brunswick.

As attorney for the Saint John River Log Driving Company and the Madawaska Log Driving Company, I hereby give notice that the said, The Saint John River Log Driving Company and The Madawaska Log Driving Company, hereby take exceptions to the plans and specifications of The Grand Falls Power Company, Limited, as now on file in the office of the Chief Commissioner of Public Works, as follows:—

1. As the proposed dam to be erected according to the said plans will raise the level of the water at that point fourteen feet above the ordinary low water level, and will create a back flow of twelve miles, a very large additional expense will be incurred in driving all logs and lumber from this point, over and above what the ordinary cost is at the present time, and therefore the company should be compelled to bear the extra expense of driving the lumber from the head of the pond, and sluicing it through the log way, to be constructed under the town of Grand Falls.

2. That it is possible, if not extremely probable that accidents may happen to the said log sluice, provisions should be made for a logway through the dam, and adequate means provided for sluicing the logs through the dam, in the case of an accident to the log tunnel and, in that event, provisions should be made for discharging into the river, through or over the dam immediately a quantity of water equal to the natural flow of the river, for the purpose of carrying the logs and lumber over the falls to the lower basin, or to the outlet of the power tunnels.

3. The said company should be compelled to erect certain jam piers above their dam in the river, at any point or points where the engineer of the log driving companies aforesaid, might designate, in order to hold in place the sheer booms provided for by the company for the purpose of directing the logs to the entrance to their log tunnel, in case the booms cannot be properly maintained without said piers, and that the said boom must be located at the points as indicated in the plans, and at no other point.

4. That according to the plans, the outlet of the log tunnel is sixteen feet above the ordinary level of the river, and if lumber were sent through the tunnel in large quantities, a jam would certainly be the result at the outlet, therefore said tunnel should be continued, either as a penstock, or an open sluice way further out into the current of the river, said point to be designated by the engineer of the log driving companies.

5. The company should be compelled, at all times when asked by the party in charge of the corporation drive, to keep a flow of not less than four feet of water in the log tunnel.

6. In case, at any time, any of the log or power tunnels should be closed, and it could be established that there was not as much water coming down as the natural flow of the river would be at that time, then, on six hours' notice from the officer in charge of the said corporation drive, the company will allow as much water to flow through the tunnels, or through an opening in the dam, as would amount to the natural flow of the river, said flowage to continue as long as required by the officer in charge of the corporation drive for driving purposes.

7. In case the said log tunnel should not prove of sufficient capacity to allow of the passage of logs at the rate of not less than two million feet per day, when they are presented at that rate, then the company shall be compelled to enlarge the same or, by some other method, provide facilities for the passing of logs from the upper basin to the lower, at that rate per day, said enlargement or other facilities to be provided within six months from the notice of such apparent failure of the proposed provisions, in this respect.

Dated this twenty-third day of February, A.D. 1906.

FRANK B. CARVELL,

Attorney for The St. John River Log Driving Co. and The Madawaska Log Driving Co.

OBJECTIONS TO THE GRAND FALLS WATER-POWER AND BOOM COMPANY TO THE PROPOSED WORKS AT GRAND FALLS.

1. The Grand Falls Water-Power and Boom Company was incorporated by Chapter 77 of the Acts of the Dominion of Canada passed on the twenty-second day of July, A.D. 1895.

2. That it is the riparian owner of the water-power rights at Grand Falls, part of said rights having been acquired by lease through the Minister of the Interior, namely, Lots A, B, and C of the ordnance lands, said lease being dated

the twenty-seventh day of April, A.D. 1894 and having been made to Edwin Jack and Walter Armstrong and by them assigned to the Grand Falls Power and Boom Company.

3. That the said Grand Falls Water-Power Company have acquired the mill, mill privileges, water-power, right of flowage, easements, &c., situate at Grand Falls.

4. That the said Grand Falls Water-Power and Boom Company are also the owner of other lands adjacent to the said Grand Falls.

5. That the erection of the works proposed by the Grand Falls Power Company, Limited, namely, the construction of dams, sluice, etc., will practically destroy the water-power and privileges now owned by the Grand Falls Water-Power and Boom Company.

6. That the tunnel proposed to be constructed by the Grand Falls Company, Limited, will seriously affect, if not practically destroy, the water-power rights of the Grand Falls Water-Power and Boom Company at Grand Falls aforesaid.

Your attention is also directed to article 3 of the Ashburton Treaty, 1842, wherein it is provided that the navigation of the Saint John river shall be free and open to both parties and shall in no way be obstructed by either. That all the products of the forest,—logs, lumber, timber boards, staves or shingles—grown on land in the state of Maine watered by the River Saint John or its tributaries shall have free access to and through said river to the seaport at the mouth, of the River Saint John.

GRAND FALLS WATER POWER AND BOOM CO.,

by HUGH H. McLEAN,

Vice-President.

DEPARTMENT OF PUBLIC WORKS OF CANADA,

CHIEF ENGINEERS' OFFICE,

OTTAWA, March 5, 1906.

Subj. Grand Falls, N.B.

SIR,—In file No. 286,270, herewith returned, Messrs. Barnhill, Ewing and Sandford transmit, on behalf of the Grand Falls Co., Ltd., plans and descriptions of site of dam and works which the company propose to construct in the River St. John, at Grand Falls, N.B. This was referred to Mr. Resident Engineer E. T. P. Shewen whose report I now have the honour to transmit.

Mr. Shewen states that the log driving companies which operate on the River St. John, the Canadian Pacific Railway Co., and the Grand Falls Water-Power and Boom Company, object to the proposed works, a copy of the objections by the latter company being sent to Mr. Shewen and is annexed to his report. He sums up the objections as follows:—

1st. The log driving companies of the River St. John which would prefer an open sluice.

2nd. The Canadian Pacific Railway Company which objects to the water being raised in which its bridge piers stand.

3rd. The Grand Falls Water-Power and Boom Company, which says that the works proposed of the Grand Falls Power Company Ltd., will seriously affect, if not practically destroy, the water-power rights of the Grand Falls Water-Power and Boom Company.

APPENDIX E.

EXTRACT from a Report of the Committee of the Privy Council, approved by the Governor General on the 6th May, 1907.

On a memorandum dated 2nd May, 1907, from the Acting Minister of Public Works, stating that on several occasions representations by deputations, petitions and otherwise, have been made to the Department of Public Works urging the necessity of providing means for preventing the alleged damages caused to riparian owners by the overflowing of its banks by the Richelieu river:

That pursuant to the above representations a report has been prepared by the office of the Chief Engineer of the Department of Public Works (a copy of resident engineer Michaud's report hereto attached), suggesting certain works as a means of stopping these annual floods.

The Minister further states that Parliament during the course of its last session provided an amount of $10,000 towards the commencement of these works.

The Minister recommends that before a commencement is made, in view of a portion of the waters affected lying contiguous to the territory of the United States, that a reference be had to the International Waterways Commission in order that the proposed improvement may have the careful consideration of that body.

The Committee submit the same for approval.

(Sgd). RODOLPHE BOUDREAU,

Clerk of the Privy Council.

The Honourable the

Minister of Public Works.

APPENDIX F.

PERMIT OF THE SECRETARY OF WAR TO THE LAKE SUPERIOR POWER COMPANY FOR THEIR REMEDIAL WORKS.

WHEREAS, By the River and Harbour Act, approved June 13, 1902, it is provided (32 Stats., 361), that, subject to the conditions therein mentioned,—

'The Michigan Lake Superior Power Company, of Sault Sainte Marie, Michigan, its successors and assigns, after first obtaining consent of the Secretary of War and the Chief of Engineers and their approval of the said canal and remedial works proposed is thereby authorized to divert water from the Saint Marys River into its water-power canal now being constructed at Sault Sainte Marie, Michigan, for water-power purposes while and so long as such works and diversion of water from said river shall not injuriously affect navigation therein, nor impair or diminish the water levels of any natural increase thereof either in Lake Superior or in the United States ship canal and locks or the navigable channels, locks, or ship canals connected therewith, whether natural or artificial now existing or which may hereafter be established or created by the United States for navigation purposes.'

AND WHEREAS, The said Michigan Lake Superior Power Company has submitted for the approval of the Secretary of War and the Chief of Engineers plans of its water-power canal and remedial works for the diversion of the water from the Saint Marys river, authorized by said Act, and has applied for consent to the Secretary of War and Chief of Engineers to such diversion;

And Whereas, The Chief of Engineers has approved the said plans, and has given his consent to such diversion, subject to acceptance by said Company of the conditions hereinafter specified;

Now Therefore, This is to certify that the Secretary of War hereby approves of the said plans, which are hereto attached and hereby gives his consent to the diversion of water from the Saint Marys river as authorized by said Act, subject to the acceptance by said company of the following condition

1. That the regulation works, including escape valves at power-house, controlling works, and remedial works, shall be operated under the inspection of the Engineer Officer in charge at the Saint Marys Falls Canal, who shall have access to them at all times.

2. That when the mean level of Lake Superior at the canal for any calendar month falls below 601·5 feet above mean tide at New York according to the levels of the United States Lake Survey Office, the flow through the canal shall be reduced, the amount of reduction increasing as to the monthly mean level falls, until it reaches 601·0 when all flow shall be stopped until the monthly mean level again exceeds 601·0, all without claim against the United States, or against any officer thereof.

3. That in addition to the requirements of condition 2 (supra), all flow shall likewise be stopped, without claim against the United States, or against any officer thereof, should the monthly mean level of the lake remain below 601·5 for a period of six consecutive calendar months, and shall not be resumed until the monthly mean level shall exceed 601·5.

4. That when the monthly mean level raises above 603·0, the flow through the canal and the remedial works shall be increased to their maximum capacity and shall so continue until the monthly mean level shall be less than 603·0, without claim against the United States, or against any officer thereof.

5. That should the monthly mean level of the lake remain above 603·0 for a period of six consecutive calendar months, said Company shall alter its works at its own expense as soon as practicable so as to allow more flow.

6. That the United States shall have the right to assume entire control of the flow of water through the canal and remedial works in case of accidents or of emergencies temporarily affecting navigation through the United States Ship Canal.

7. That should cross currents detrimental to navigation be created by the intake or by the outflow of the canal, said Company shall construct such booms, training wall, or other works, as may be necessary to remedy the evil.

8. That said Company, in its arrangement and construction of remedial works, shall leave a suitable channel and water flow for the passage of logs over and through Saint Marys Falls.

9. That these limitations are in addition to the special limitations of the Act of June 13, 1902, regarding riparian or other rights of any person or corporation and the remedies therefore.

10 That the elevations above mean tide at New York, above specified, are those established and in use at this date by the office of the Survey of the Northern and Northwestern Lakes, commonly known as the Lake Survey Office, at Detroit, Michigan.

11. Finally, the object and aim of the foregoing paragraphs being to hold the waters of the lake and river under the absolute control of the United States in the interest of navigation it is expressly understood that said Company shall not be entitled to damages should the government at any time or for any cause exercise its right to control and suspend the flow of water through the power canal in the interest of navigation.

Witness my hand this 12th day of December, 1902.

ELIHU ROOT,
Secretary of War.

This Instrument is also executed by the Michigan Lake Superior Power Company by Francis H. Clergue its President, thereunto lawfully authorized, this ninth day of December, 1902, in testimony of the acceptance by said Company at the foregoing conditions.

The Michigan Lake Superior Power Company

By FRANCIS H. CLERGUE, *President.*

Attest:

H. Von Schon.
F. T. Trempe.

APPENDIX G.

Bill of the Senate of Canada concerning the Remedial Works of the Lake Superior Power Company.

Bill as Passed March 14, 1907.

(HH.) (1907.)

An Act respecting The Lake Superior Power Company.

Whereas a petition has been presented by the Lake Superior Power Company praying that it be enacted as hereinafter set forth and it is expedient to grant the prayer of the said petition: Therefore His Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:—

1. The Lake Superior Power Company, notwithstanding the construction by it of the regulating works at the head of the falls in the St. Mary river at the Sault Ste. Marie, in the province of Ontario, may proceed to obtain the approval, by the Governor in Council, of the site and plans of the said regulating works under the provisions of *The Navigable Waters' Protection Act*, chapter 115 of *The Revised Statutes, 1906*; and upon such approval being obtained, the provisions of the said Act shall apply to the said regulating works so constructed as fully and to the same extent as if the said regulating works had not been constructed before the approval of the plans and site thereof by the Governor in Council.

SESSIONAL PAPER No. 34

AMERICAN SECTION.

THIRD PROGRESS REPORT, DECEMBER 1, 1907.

INTERNATIONAL WATERWAYS COMMISSION, OFFICE OF AMERICAN SECTION,
328 FEDERAL BUILDING,
BUFFALO, N.Y., November 27, 1907

MR. SECRETARY,—1. The American members of the International Waterways Commission have the honour to submit the following progress report covering their work for the year ending December 1, 1907:

ORGANIZATION.

2. A change occurred in the personnel of the commission resulting from the resignation in February of Dr. W. F. King, of the Canadian section, who was replaced by Mr. W. J. Stewart, appointed April 6. The full commission held three and the American section six meetings during the year at Buffalo and Toronto. In the interval between the meetings the collection and study of the data bearing upon the various questions before the commission were continued.

NIAGARA FALLS AND RIVER.

3. An account of the circumstances leading up to the passage by Congress of the 'Act for the control and regulation of the waters of Niagara River, for the preservation of Niagara Falls, and for other purposes,' approved June 29, 1906, and of our subsequent action under that Act was given in our last progress report. Further action has since been taken as follows:

4. An application for the diversion of 175 cubic feet per second from the Niagara River below the falls having been received by the War Department from the executor of the estate of Henry E. Woodford, was referred to us by the Chief of Engineers, U. S. Army, in a letter dated December 22, 1906. The secretary of the American section made an investigation and report, and under date of January 11, 1907, the Chief of Engineers was informed that 'it was the sense of the section that if any permit be required in this case there is no objection to granting one for the diversion of 175 cubic feet per second, the amount asked for.' The correspondence upon the subject will be found in Appendix A.

5. The industries using water from the Erie Canal are numerous, and the quantity of water diverted is comparatively small. Many of these industries are located one below the other on Eighteen-mile Creek, and use the same water successively. Some difficulty having been found in determining, with the information at hand, exactly how and to whom to issue the permits for the diversion of water from the Erie Canal, further investigations were made, which included a careful re-examination of the ground and measurements of flow, with the preparation of maps showing the location of the industries at and near Lockport and at Medina, and a public hearing was held at Buffalo, March 2, 1907, at which all parties in interest were given an opportunity to be heard. The result of these investigations was given in our report to the honourable Secretary of War, dated March 5, 1907 (copy appended marked 'B'), and a form of permit was submitted, which was subsequently adopted. It grants authority to the first user, the Lockport Hydraulic Company, to divert 500

cubic feet per second. The subsequent use of this water by other companies is deemed to be not properly a diversion of Lake Erie water, and not to require a permit from the Secretary of War. The permit is granted with the express understanding that it confers no authority whatever to divert water from the Erie Canal without the consent of the State of New York, and that it is subject to such regulations and other conditions as the State may impose.

6. Under date of June 5, 1907, the Niagara Falls Hydraulic Power and Manufacturing Company addressed an open letter to the honourable Secretary of State, reciting its claim of the right to divert water from the Niagara River and requesting that that right be protected and secured to the company by suitable provisions in any treaty which might be made between the United States and Great Britain upon the subject of the international waterways. Under date of June 25, this letter was forwarded by the Acting Secretary of State to the Secretary of War, and was referred to us by your indorsement of July 26. It was the subject of our report dated September 9, 1907 (copy appended marked 'C').

7. The Committee on Rivers and Harbours of the House of Representatives, at the last session of Congress, passed the following resolution, viz:

'Resolved by the Committee on Rivers and Harbours of the House of Representatives, United States, That the bill H. R. 25546, entitled, 'A bill amending an Act entitled 'An Act for the control and regulation of the watersofNiagara River, for the preservation of Niagara Falls, and for other purposes,' approved June twenty-ninth, nineteen hundred and six,' be referred to the International Waterways Commission, with request that said commission consider the bill in question and make report on same to this committee before the beginning of the next session of Congress,' which resolution was forwarded to the chairman of the American section by the clerk of the committee with letter dated May 24, 1907. The matter was laid before the commission at its session of October 24, 1907, and was referred to a committee for a report to be submitted to the commission at its next meeting.

CHICAGO DRAINAGE CANAL.

On the 4th of January, 1907, the full commission submitted to the two Governments a report upon the Chicago Drainage Canal, which contained the following recommendations, viz:

'The waters of Lake Michigan in the United States, the waters of Georgian Bay in Canada, and the waters of Lake Superior, partly in the United States and partly in Canada, all form sources of supply of the Great Lakes system, finding their way by the St. Lawrence to the sea. All are interdependent, and there can be no diversion from any of them without injury to the whole system. By Article XXVI of the treaty of 1871 it is provided that 'navigation of the river St. Lawrence, ascending and descending from the forty-fifth parallel of north latitude, where it ceases to form the boundary between the two countries from, to, and into the sea, shall forever remain free and open for the purposes of commerce to the citizens of the United States, subject to any laws and regulations of Great Britain, or of the Dominion of Canada, not inconsistent with such privileges of free navigation.' It is desirable that in any treaty arrangement the waters of Lake Michigan, Georgian Bay, and all other waters forming part of the Great Lakes system should be declared to be 'forever free and open for the purposes of commerce' to the citizens of the United States and the subjects of His Britannic Majesty, subject to any laws and regulations of either country, and not inconsistent with such privilege of free navigation.

The preservation of the levels of the Great Lakes is imperative. The interest of navigation in these waters is paramount, subject only to the right of use for domestic purposes, in which term is included necessary sanitary purposes. In

our report of November 15, 1906, upon the application of the Minnesota Canal and Power Company to divert certain waters in Minnesota, we recommended, among other things, 'that any treaty which may be entered into should define the uses to which international waters may be put by either country without the necessity of adjustment in each instance, and would respectfully suggest that such uses should be declared to be (a) uses for necessary domestic and sanitary purposes; (b) service of locks for navigation purposes; (c) the right to navigate.' It is our opinion that so far as international action is concerned a treaty provision of that kind is all that is required in this case. We accordingly renew our recommendation of November 15, 1906, just quoted.

A careful consideration of all the circumstances leads us to the conclusion that the diversion of 10,000 cubic feet per second through the Chicago river will, with proper treatment of the sewage from areas now sparsely occupied, provide for all the population which will ever be tributary to that river and that the amount named will, therefore, suffice for the sanitary purposes of the city for all time. Incidentally it will provide for the largest navigable waterway from Lake Michigan to the Mississippi River which has been considered by Congress.

We therefore recommend that the Government of the United States prohibit the diversion of more than 10,000 cubic feet per second for the Chicago Drainage Canal.

A full copy of the report will be found in Appendix D.

9. It is interesting to note that the trustees of the sanitary district of Chicago have raised a question as to the right of the Secretary of War to control the diversion of water from Lake Michigan, which question will be decided in the courts of law. The Secretary having declined, under date of March 14, 1907, to grant a permit, for which the board had applied to him, to reverse the flow of Calumet River, the board nevertheless at its session of September 18, 1907, decided to proceed with the construction of the proposed diversion channel, but to first give 'notice of its intention so to do to the Secretary of War and to the Attorney-General that they may, if they see fit, take such steps as they think proper to protect the rights, if any, of the General Government in the premises before the expenditure by the district of any considerable portion of the eight or ten millions of dollars necessary to construct the said channel'. As a matter of form, it began work on a very small scale October 16, 1907, whereupon, at the request of the War Department, the Department of Justice instituted injunction proceedings. The case has not as yet been heard.

RICHELIEU RIVER.

10. Under the direction of the Department of Public Works of Canada, a report was prepared in 1902 upon the subject of damage by overflow of the Richelieu river and a plan was submitted for correcting the evil. At its last session the Canadian parliament appropriated $10,000 for beginning the works proposed. The latter will be entirely within Canadian territory, but inasmuch as they may affect the interests of the United States or of its citizens upon Lake Champlain, the Canadian government before beginning the work referred the matter to the International Waterways Commission. (See Appendix E.) The matter was considered by the commission at its session in Toronto, October 24, 1907, and the following resolution was passed, viz:—

'Whereas certain valuable lands in the valley of the Richelieu River, the outlet of Lake Champlain, are subject to damage by overflow; and

'Whereas a plan for the reclamation of said lands, submitted by Resident Engineer J. B. Michaud, April 7, 1902, to the Canadian government, was referred by that government to the International Waterways Commission under date of May 6, 1907; and

'Whereas the international question involved relates only to the effect of the proposed works upon the interests of the United States or of its citizens upon Lake Champlain; and

'Whereas the average level of Lake Champlain is 96·1 feet above tide water, and the monthly mean level during floods is about 100:

'*Resolved*, That it is the opinion of the International Waterways Commission that the works proposed can be constructed without injury to the interests of the United States or its citizens upon Lake Champlain, provided a movable dam be constructed at St. Johns, and so operated that the flood waters of Lake Champlain shall be allowed to rise to a monthly mean level of 97 and the level of the lake shall thereafter be maintained at or above 95.'

INTERNATIONAL BOUNDARY IN LAKE ERIE.

11. In our last progress report we stated that in August, 1906, 'a large number of nets were placed in Lake Erie by the Keystone Fish Company, of Erie, Pa., near the middle of the lake, but on what they claim is the American side of the boundary. Most of these nets were promptly seized and confiscated by the Canadian vessel *Vigilant*. The commander of the *Vigilant* then proposed to the American fishermen to show them the boundary and aid them in marking it with buoys, so that they might always remain on their own side of the line if they desired to do so. The proposal was forwarded to the honourable Secretary of State and by him to the honourable Secretary of War under date of September 5, 1906, with the request that it 'be referred to the International Waterways Commission, with the inquiry whether it is known that the American and Canadian charts of the locality agree as to the distance to be logged from the gas buoy at Erie to the boundary line on the usual fishing grounds.

12. 'It has been necessary to reduce the various charts upon which the boundary is marked to the same system of projection and the same scale in order to compare them, and this has required much time. The British admiralty chart and the United States lake survey chart are projected on the polyconic system; the hydrographic chart issued by the United States Navy Department is projected upon the Mercator system; while the chart on file in the State Department with the treaty of Ghent, as near as can be ascertained, is on the plane rectangular system; with one exception, each is of a different scale from any other. It is found that the boundary, as laid down on the United States hydrographic chart, differs widely from that on the British admiralty chart. They both derive their authority from the treaty of Ghent. The map on file with the treaty is so inaccurate that no two persons would probably transfer the boundary line marked thereon to a modern chart in the same way. It is, in fact, worthless for its purpose. The only guide for the location of the boundary in Lake Erie, except at the eastern and western extremities, is in the expression in the text of the treaty 'through the middle of said lake.' Under that description a variety of lines may be laid down.

13. Under date of January 4, 1907, the full commission submitted to the two Governments a report in which were the following recommendations, viz:

(*a*) That the entire boundary line from the point where the forty-fifth parallel of north latitude meets the middle of the St. Lawrence River, through that river, the Great Lakes, and connecting waters, in accordance with the true intent and meaning of the treaties of 1783, 1814 and 1842, be located to accord as nearly as possible with the lines fixed by the commissioners appointed under the treaty of Ghent, and the treaty of 1842, be delineated upon modern charts, and be so described by reference to fixed monuments, where necessary, that it can in the future be relocated at any given point by survey.

(*b*) That the location, delineation on modern charts, and monumenting of the boundary line proceed under the direction of this commission or another

international commission, to be appointed, and that, when it is located, laid down on modern charts, and monumented, it be finally fixed and determined by treaty accordingly.

(*c*) That this commission be authorized to locate, lay down upon a modern chart, and monument the boundary line through Lake Erie.

A full copy of the report will be found in Appendix F.

SUMMER RESORT NEAR LONG SAULT RAPIDS.

14. In our last progress report reference was made to the application of Mr. Smith L. Dawley, of Ogdensburg, N.Y., for a permit to construct works in the river St. Lawrence near Long Sault Island, and it was stated that the information at hand concerning the scheme was not sufficient to justify the commission in making a recommendation. On the 4th of January, 1907, the full commission adopted the following resolution, a copy of which was forwarded to each Government, viz:

'Whereas Mr. Smith L. Dawley, of Ogdensburg, N.Y., submitted to the honourable Secretary of War of the United States, under date of May 28, 1906, an application for permission to construct at Long Sault Island, in the town of Massena, St. Lawrence County, N.Y., dikes, retaining walls and such other structures as might be necessary to create "an attractive summer resort with navigable approaches thereto, and the development of a water-power entirely in that portion of the St. Lawrence River that is within the United States," which application was referred to the International Waterways Commission by indorsement of the Secretary of War, dated June 2, 1906; and

'Whereas the application did not furnish information sufficient to justify a recommendation in the matter, and the efforts of the commission to obtain such information from Mr. Dawley have thus far been without success; and

'Whereas the commission now learns that Mr. Dawley has transferred his rights at Long Sault Island to the Pittsburg Reduction Company, and it is the opinion of the Commission that if any permit for the construction of works at this place is to be granted, it should be dealt with upon a direct application from the beneficiary: Therefore, be it

'*Resolved*, That the International Waterways Commission recommend to the honourable Secretary of War of the United States that the application of Mr. Smith L. Dawley be denied.'

POWER WORKS IN ST. LAWRENCE RIVER NEAR LONG SAULT ISLAND.

15. There was introduced in the House of Representatives on the 18th day of February, 1907, ' a bill to authorize the construction of dams, canals, power stations, and locks for the improvement of navigation and development of water power on the St. Lawrence River at and near Long Sault Island, St. Lawrence County, N.Y.—copy appended marked 'G'. The bill failed to become a law, but in anticipation of its being again presented at the next session of Congress, it was referred to us by your indorsement order of March 21, 1907, from which the following is an extract, viz:

'The Chief of Engineers will therefore furnish copies of all correspondence and any explanatory maps in his possession to the International Waterways Commission, and the American section of the International Waterways Commission will make a report to the Chief of Engineers not only of their own views, but also of the result of conferences with the British section, should that section be willing to consider the same.'

16. The matter was considered by the commission at its session of April 18, 1907, and a public hearing was held. Representatives of the corporation seeking the franchise stated that no plans for the works had been prepared, that they had a large engineering force at work in the field, and hoped to have

their plans ready early in the autumn, and they would prefer that action by the commission be deferred until the plans could be fully explained to it. The subject was again considered at the session of October 24, 1907, when another public hearing was held. The plans were exhibited to the commission, and, though not entirely completed, were sufficiently advanced to give a good general idea of what it is proposed to do. A letter from the prime minister of Canada, dated October 12, 1907 (copy appended marked 'I'), was presented, stating that the minister of railways and canals had the matter under investigation, and suggesting that it would be inadvisable for the commission to deal with the matter until the investigations were completed. Action was accordingly deferred.

RAINY RIVER AND RIVER ST. JOHN.

17. Under date of May 23, 1907, the secretary of the Canadian section transmitted to the chairman of the American section copies of documents relating to the Rainy River and the river St. John, which has been referred by the Canadian Government to the International Waterways Commission. Neither of these rivers is tributary to the Great Lakes and St. Lawrence River system, and neither of them, therefore, comes within the limits prescribed to the American members under the instructions which they received in 1905. The fact that in the case of the Minnesota Canal and Power Company, which was the subject of the report of the International Waterways Commission, dated November 15, 1906, the Rainy River was considered incidentally in connection with the proposed diversion to Lake Superior of water naturally tributary to that river, gave some colour to the idea that it might now be again considered by the American members. In deference to the Canadian government, the question of jurisdiction in the cases of both rivers was submitted for the consideration of higher authority, by letter dated November 6, 1907 (copy appended marked 'K').

REGULATION OF LAKE ERIE.

18. During the year that part ofsection 4 of the River and Harbour Act creating the commission which reads—

'* * * The said commissioners shall report upon the advisability of locating a dam at the outlet of Lake Erie, with a view to determining whether such dam will benefit navigation, and if such a structure is deemed advisable, shall make recommendations to their respective Governments looking to an agreement or treaty which shall provide for the construction of the same, and they shall make an estimate of the probable cost thereof.' * * *

has been under consideration, and a large amount of labour has been expended upon an investigation of the problem. While there are considerable data in existence bearing upon this subject, the commission has found that more are needed before a complete solution of the problem can be offered. The Engineer Department, United States Army, is obtaining the necessary information, and as soon as it is available the investigations now under way will be completed and a report submitted.

O. H. ERNST,
Brig. Gen. U. S. Army, Retired,
Chairman, American Section.

GEORGE CLINTON,
Member, American Section.

E. E. HASKELL,
Member, American Section.

Attest:

W. EDWARD WILSON,
Secretary, American Section.

Hon. WM. H. TAFT,
Secretary of War, Washington. D. C.

SESSIONAL PAPER No. 34

APPENDICES.

A.—Letter from the Chief of Engineers, dated December 22, 1906, relating to the application from the Woodford estate for a permit to divert 175 cubic feet per second from Niagara River below the falls. Report of secretary, American section, January 4, 1907, and letter from chairman to Chief of Engineers, January 11, 1907.

B.—Report of American section upon the diversion of water from the Erie Canal, dated March 5, 1907.

C.—Report of American section, dated September 9, 1907, upon the letter of June 5, 1907, to the Secretary of State from the Niagara Falls Hydraulic Power and Manufacturing Company.

D.—Report of commission upon the Chicago Drainage Canal, dated January 4, 1907. (Printed in previous Reports. See page 515).

E.—Extract from a Report of a committee of the privy council, approved by the Governor-General of Canada, May 6, 1907, and copy of Engineer Michaud's report and of his supplementary report upon the necessity of providing means for preventing the alleged damages on the banks of the Richelieu River.

F.—Report dated January 4, 1907, upon the boundary through Lake Erie. See page 576.

G.—Bill to authorize the construction of dams, canals, etc., on the St. Lawrence River at and near Long Sault Island.

H.—Act of New York legislature, May 23, 1907.

I.—Letter from Prime Minister of Canada, dated October 12, 1907, to chairman of Canadian section, relating to the project for power development near Long Sault Rapids, in St. Lawrence River.

K.—Letter to Secretary of War, dated November 6, 1907, submitting question of jurisdiction over Rainy River and St. John River.

Appendix A.

War Department,

Office of the Chief of Engineers,

Washington, December, 22, 1906.

General: 1. Since the consideration of the question of diversion of water from the Niagara River under the provisions of the law of June 29, 1906, and the rendering of a report thereon by Captain Kutz and the American section of the International Waterways Commission, the executor of the estate of Henry E. Woodford has submitted a further brief and letter reciting the fact that arrangements have been made for the use of power, and asking for a permit for the diversion of 175 cubic feet of water per second.

2. In connection with the former application the Secretary of War stated: 'With reference to the application of the Niagara Falls Trust Company as executor and trustee of the estate of Henry E. Woodford, deceased, there seems to be no necessity for granting a temporary permit, for the water is not being used, and it is questionable whether a permit is necessary, and therefore consideration of this question will be postponed until final decision.'

3. It would appear that since that ruling was made the conditions have changed, and that the question of such diversion may have to have consideration under the law.

4. It is understood that the matter of diversion and transmission at Niagara Falls will be taken up by the secretary in the near future, and it is believed that when the matter comes before him he will desire the views of your commission. I therefore take the liberty of transmitting the matter to you direct to avoid delay.

Very respectfully,

A. Mackenzie,

Brigadier-General, Chief of Engineers, U. S. Army.

Brig. Gen. O. H. Ernst, U. S. Army, Retired,

Chairman of American Section,

International Waterways Commission, Washington, D. C.

International Waterways Commission,

Office of Chairman American Section,

Room 427, Mills Building Annex,

Washington, D. C., January 11, 1907.

General,—I have the honour to acknowledge the receipt of your letter of the 22nd ultimo upon the subject of an application from the executor of the estate of Henry E. Woodford for a permit to divert 175 cubic feet of water per second from the Niagara River.

The matter was referred to the secretary of the American section of the International Waterways Commission for investigation. A copy of his report of the 4th instant is inclosed. It was considered by the American section at their meeting at Toronto on the 4th instant. It was the sense of the section that if any permit be required in this case there is no objection to granting one for the diversion of 175 cubic feet per second, the amount asked for.

Yours very respectfully,

O. H. Ernst,

Brigadier General U. S. Army, Retired,

Chairman of American Section, International Waterways Commission.

Brig.-Gen. Alexander Mackenzie,

Chief of Engineers, U. S. Army, Washington, D. C.

Toronto, Ontario, January 4, 1907.

Sirs,—In accordance with your instructions dated December 22, 1906, I have the honour to report upon the matter of the application of the Niagara Falls Trust Company, as executor and trustee of the estate of Henry E. Woodford, deceased, for the right to divert waters from the Niagara river.

In a brief dated November 5, the Niagara Falls Trust Company, as executor and trustee of the estate of Henry E. Woodford, deceased, prays that a permanent permit be issued to it for the diversion of 175 cubic feet of water per second from the Niagara River, and states that it is a renewal of the former application to the Secretary of War due to a change in conditions caused by the actual use of this water power under a lease to Clark Shipston, for one year from the 1st day of October, 1906.

On December 27 I inspected the power plant of the Woodford estate in company with a representative of the Niagara Falls Trust Company. It is situated at the foot of the talus slope on the east bank of the Niagara River, at the head of the Whirlpool Rapids, about a mile and a half below the Falls of Niagara, and between the Cantilever and Suspension bridges. It consists of a headrace or intake about 150 feet long, part of which is a natural channel formed by large pieces of talus falling into the river and forming a dyke, through which the water is now carried to a power house. The power house consists of a wooden flume, in which is installed a 50-inch upright hand Sampson turbine made by the James Leffel Water Wheel Company. The wheel works under a head of about 7 feet, and the turbine company guarantees it to develop 93½ horsepower under the above-mentioned head, using 145 cubic feet per second. The vertical shaft of the turbine is connected by beveled gears to a horizontal shaft, on which is fastened a pulley about 8 feet in diameter which transmits power, by means of a wire rope, to the grist and flouring mill on the top of the cliff. The water, after passing through the wheel, is discharged into a short tailrace not over 100 feet long. Mr. Wallace C. Johnson, consulting engineer, in a letter to Hon. F. A. Dudley, Niagara Falls, N. Y., dated November 7, 1906, states that it would require the use of 175 cubic feet of water per second to develop 100 horse-power at this plant.

The land along the east bank of the river, from a point below the tailrace to a point about 1,000 or 2,000 feet above the power house, is owned by the Woodford estate.

The grist and flouring mill previously mentioned on the top of the cliff is also owned by this estate and is in operation under the Shipston lease.

CONCLUSIONS.

1. The Woodford estate is the owner of the riparian rights along the river where this power development is located.
2. The Niagara River is unnavigable in this reach of the Whirlpool Rapids.
3. The development of power at this point does not injure or interfere with the navigable capacity of said river.
4. This development of power does not affect the integrity and proper volume of Niagara River as a boundary stream.
5. The scenic grandeur of Niagara Falls is not affected or impaired in any way by this development.

All of which is respectfully submitted.

W. EDWARD WILSON,
Secretary, American Section.

APPENDIX B.

REPORT OF AMERICAN SECTION UPON THE DIVERSION OF WATER FROM THE ERIE CANAL.

INTERNATIONAL WATERWAYS COMMISSION,
OFFICE OF CHAIRMAN AMERICAN SECTION,
WASHINGTON, D.C., March 5, 1907.

Mr. SECRETARY:—The American members of the International Waterways Commission, in their report to you dated November 15, 1906, upon the diversion of water at Niagara Falls on the American side, in discussing the diversion of water from the Erie Canal, expressed the opinion that the persons first

using said water should have a permit from the Secretary of War, and that persons using it afterwards might be allowed to do so without a permit. They stated that the information necessary for the issuance of such permits was not then at hand, that they had taken steps to procure it, and that if you concurred in the opinion just expressed, they would submit a supplementary report at a later date. In your opinion dated January 18, 1907, you expressed yourself as follows:

'The water is used over and over again. It seems to me that the permit might very well be granted to the first user. As the water is taken from the canal, which is State property, and the interest and jurisdiction of the Federal Government grow out of the indirect effect upon the level of the lake, the permit should recite that this does not confer any right upon a consumer of the water to take the water from the canal without authority, and subject to the conditions imposed by the canal authorities, but that it is intended to operate, and its operation is limited to confer, so far as the Federal Government is concerned, and the Secretary of War is authorized, the right to take the water and to claim immunity from any prosecution or legal obligation under the first section of the Burton Act. I shall refer the form of the permit with these instructions to the International Waterways Commission to prepare it.'

The American members now have the honour to submit the supplementary report accordingly.

From Lake Erie to Lockport, N.Y., the Erie Canal is practically upon the same level with the lake, but with a slope sufficient to provide the necessary flow. At Lockport it drops about 54 feet through a series of locks, to what is known as the 60-mile level. Water for power purposes is extracted from the canal above the locks, and returned to the canal below the locks. A portion of this water is there again extracted for power purposes at various points on the 60-mile level, and is not returned to the canal, the principal point being at Lockport, where various industries located at and below Lockport on Eighteen-mile Creek use the water in succession one after the other.

The figures given in our former reports as to the total amount of water extracted from the Erie Canal were given upon the authority of officials of the State of New York. There were no details as to exactly what persons or corporations were exercising the privilege, what amount of water each was using, and by what authority he was using it, and there was some doubt as to whether all of the water diverted above the locks was returned to the canal or not. The commission through its secretary has obtained this information, so far as practicable, particularly with reference to the diversions at Lockport, both above and below the locks. A map of that locality showing the location of the various industries has been constructed. New measurements of the flow of water at that place have been made, and their results checked with the capacity of the machines actually served. A map has been prepared also showing the location of the industries at Medina. Copies of these maps will be forwarded if desired. The figures thus obtained are somewhat larger than those reported and will be used here.

Water for power purposes is extracted from the upper level at Lockport through a raceway on the south side and a tunnel on the north side of the canal, the amount taken through the raceway being about 390 cubic feet per second, and that through the tunnel being about 610 cubic feet per second, or about 1,000 cubic feet in all. Both raceway and tunnel belong to the Lockport Hydraulic Company, a corporation organized and incorporated in 1856.

This company derives its rights from a lease made by the canal commissioners of the State of New York in 1826 to Richard Kennedy, of Lockport, and Junius H. Hatch, of New York, under the authority of a law of the New York legislature enacted in 1825 (ch. 275 Laws of 1825, sec. 3). By this lease there was granted to Messrs. Kennedy and Hatch, their heirs and assigns, 'all the surplus

waters which without injury to the navigation or security of the canal may be spared from the canal at the head of the locks in the village of Lockport,' and it was furthermore agreed 'that the canal commissioners reserve to themselves and the legislature the right to limit, control, or wholly resume the said waters and all the rights granted by this lease whenever, in the opinion of the canal commissioners or of the legislature, the safety of the canal or its appendages or the necessary supply of water for the navigation of the canal shall render such limitation, control, or resumption necessary.' The Lockport Hydraulic Company are the present assignees of this lease, but they hold it subject to the rights granted by Messrs. Kennedy and Hatch in their subleases. The first of these subleases is now owned by Adelaide C. Beverly, Joseph A. Ward, and Mary Anna Evans, and carries the right to use 75 cubic feet per second, which right is leased to the Lockport Gas and Electric Light Company. The second of the subleases is now owned by the Thompson Milling Company, and carries the right to use 35 cubic feet per second. The third sublease is now owned by the Franklin Mills Company, and carries the right to use 35 cubic feet per second. Each of these companies is using more water than its prior rights entitle it to, the surplus being obtained from the Lockport Hydraulic Company. The first is using 22 cubic feet, the second 40 cubic feet, and the third 20 cubic feet per second more than its prior rights. They are all located upon the raceway on the south side of the canal, and may all be considered as tenants of the Lockport Hydraulic Company.

Other concerns located upon the raceway, and obtaining water from the Lockport Hydraulic Company exclusively as tenants, are—

	Cubic feet per second.
The city of Lockport, using	121
Grigg Brothers, using	15
Trevor Manufacturing Company, using	7
Western Block Company, using	11
Boston and Lockport Block Company, using	11
Add for prior rights	145
Add for surplus furnished companies having prior rights	82

Total diverted through race way, 392 cubic feet per second.

The principal lessee taking water from the tunnel on the north side of the canal is the Lockport Pulp Company, using about 600 cubic feet per second. A small amount of water, estimated at about 6 cubic feet per second is taken by the Richmond Manufacturing Company also from the tunnel.

It thus appears that all water diverted for power purposes from the Erie Canal at Lockport above the locks, and amounting to 1,000 cubic feet per second, is diverted by the Lockport Hydraulic Company. It is believed that this company is 'now actually producing power' without the meaning of the law, acting as it does through its tenants.

The water diverted here is returned to the canal below the locks, where a portion of it is required for the service of the canal to provide for leakage, evaporation, etc., and the remainder is again diverted for power purposes, or is wasted through spillways. In the level below the locks, known as the 60-mile level, the diversion for power purposes occurs at Lockport through Eighteen-mile Creek, at Middleport, at Medina, at Eagle Harbor, at Albion, at Holley, and at other places. This level receives water other than that from Lake Erie through Oak Orchard Creek and the Genesee River, but it has been impossible within the time available to ascertain the exact amount of these contributions, although they are believed to be small during the dry season.

The diversions for power purposes are at Lockport below the locks 332 cubic feet, at Middleport 30 cubic feet, at Medina 195 cubic feet, and small amounts at other places. Allowing for the contributions from tributary streams, it

may be estimated that the amount of Lake Erie water diverted from this level for power purposes will not exceed 500 cubic feet per second during dry seasons, and will be very much less during wet seasons. As above explained, the amount of Lake Erie water which reaches this level, through the works of the Lockport Hydraulic Company is about 10,000 cubic feet per second. Of this a certain portion is required for navigation purposes in the 60-mile level, and under the law it may be used without the permission of the Secretary of War. Unfortunately, it has not been possible, within the time available, to ascertain exactly what that amount is. Manifestly it will vary greatly with the seasons of the year and with different years. From the best data available it is estimated at about 500 cubic feet per second during the average dry season. This leaves 500 cubic feet per second diverted from the canal above the locks for power purposes exclusively, for which permission of the Secretary of War is necessary. The diversion of this same water from the canal below the locks does not seem to require his permission. The spirit and intent of the law would seem to be carried out if a permit be granted to the Lockport Hydraulic Company for the diversion of 500 cubic feet per second, and no other permits be granted.

The question arises what will be the effect upon the interests of the Lockport Hydraulic Company of granting a permit to divert only 500 cubic feet per second. It is using 1,000 cubic feet, of which one-half is at times required for navigation purposes, and is returned to the canal for that purpose. But not all of that amount is required for navigation purposes throughout the year. Leakage and evaporation in the 60-mile level will be less in the winter than in the summer, and the contributions from the tributaries of that level will be greater during a wet season than during a dry one. The differences are variable and can not be specified. To enable the company to use the full 1,000 cubic feet which it is now using, it will be necessary either to assume that the amount required for navigation purposes is constant or to grant it a permit for more than 500 cubic feet per second. The objections to the former alternative seem to us of less importance than those to the latter. It is impossible to measure this water with absolute precision. All of the numbers used are approximations, and it must be assumed that this was understood by the lawmaking power. Considered in connection with the preservation of Niagara Falls, which was the object of the law, the total quantities involved are small, and the difference in the amounts required for navigation purposes at different seasons may be said to be insignificant. We have therefore assumed that the amount to be allowed for navigation purposes would be 500 cubic feet per second and would be constant throughout the year. It is desirable that if a Federal officer be charged with enforcing the terms of the permit he be informed of this understanding.

We inclose a form of permit which we recommend for adoption. It has been prepared after a public hearing in Buffalo, at which all parties in interest were given an opportunity to be heard. It grants 500 cubic feet per second to the Lockport Hydraulic Company, which, added to the 8,600 cubic feet allotted by the honourable Secretary of War to the Niagara Falls Power Company and the 6,500 cubic feet allotted to the Niagara Falls Hydraulic Power and Manufacturing Company, make up the total 15,600 cubic feet per second available under the law.

Yours, very respectfully,

O. H. Ernst,

Brigadier-General, U.S. Army, Retired Chairman of American Section.

George Clinton, *Member.*

E. E. Haskell, *Member.*

Hon. Wm. H. Taft,
Secretary of War.

SESSIONAL PAPER No. 34

PROPOSED FORM OF PERMIT TO LOCKPORT HYDRAULIC COMPANY FOR DIVERSION OF WATER AT LOCKPORT, N.Y.

Whereas by section 2 of an Act of Congress approved June 29, 1906, entitled 'An Act for the control and regulation of the waters of Niagara River, for the preservation of Niagara Falls, and for other purposes', it is provided that the Secretary of War is authorized to grant permits for the diversion of water in the United States from the Niagara River or its tributaries, for the creation of power, to individuals, companies, or corporations which are now actually producing power from the waters of said river or its tributaries in the State of New York, or from the Erie Canal, to an amount not exceeding in the maximum 8,600 cubic feet per second to any one individual, company, or corporation, and not exceeding an aggregate amount of 15,600 cubic feet per second; and

Whereas waters are being diverted from the Erie Canal for the creation of power by the Lockport Hydraulic Company, a corporation organized under the laws of the State of New York, at Lockport, N.Y., by the abstraction of approximately 1,000 cubic feet of water per second from above the locks at said place, which water is returned to the Erie Canal below the locks, of which total quantity 500 cubic feet is required for navigation purposes and the remaining 500 cubic feet is not required for navigation purposes; and

Whereas the said waters not required for navigation purposes, after being returned to the canal below the locks, are again diverted from the canal and are used for power purposes by various persons and corporations located upon Eighteen-mile Creek, at and below Lockport, and at Middleport, at Medina, at Eagle Harbor, at Albion, at Holley, and at other places, and are not returned to the canal, many of the persons or corporations on Eighteen-mile Creek using the same water in succession, one after the other; and

Whereas application has been made to the Secretary of War by the Lockport Hydraulic Company for permission to divert 500 cubic feet per second from the Erie Canal at Lockport above the locks, and application has been made by various persons and corporations to divert various amounts from the Erie Canal below the locks; and

Whereas the diversion of water from the Erie Canal below the locks is not properly the diversion of water from the Niagara River or its tributaries, since said water diverted below the locks has already been diverted from above the locks and has been used for power purposes;

Now, therefore, this is to certify that the Secretary of War hereby grants permission to the Lockport Hydraulic Company, said applicant, to divert waters of the Niagara River and its tributaries from the Erie Canal at Lockport, N.Y., above the locks, for power purposes, not exceeding 500 cubic feet per second; it being distinctly understood that the waters so diverted shall be returned to the canal below the locks, and that this permit shall inure to the benefit of all persons and corporations now using said waters for power purposes, whether lessees of the applicant or having the right to be furnished by it with water, and including the persons and corporations now diverting water as aforesaid from the Erie Canal at Eighteenmile Creek, Middleport, Medina, Eagle Harbor, Albion, Holley, and other places on the lower level.

This permit is granted upon condition and with the understanding that it does not confer upon the applicant or said other persons or corporations any authority whatever to divert water from the Erie Canal without the consent of the State of New York, and that this permit is subject to any and all regulations which may be imposed upon the diversion of water from said canal by said State, and, further, that this permit is made subject to the jurisdiction of said State to alter, improve. or abolish the said canal and to prevent the diversion of any water whatever therefrom, and this permit shall not be taken to impose

any obligation whatever upon the said State or the authorities thereof. It is intended to confer, only so far as the Federal Government is concerned, and the Secretary of War is authorized, the right to take the water and to claim immunity from any prosecution or legal obligation under the first section of the Act approved June 29, 1906, above mentioned.

Appendix C.

REPORT OF AMERICAN SECTION, UPON THE LETTER OF JUNE 5, 1907, TO THE SECRETARY OF STATE FROM THE NIAGARA FALLS HYDRAULIC POWER AND MANUFACTURING COMPANY.

International Waterways Commission,
Office of Chairman, American Section,
Washington, D.C., September 9, 1907.

Sir,—The American members of the International Waterways Commission have the honour to return herewith the letter dated July 25, 1907, addressed to yourself by the honourable Secretary of State, inclosing a letter dated June 5, 1907, which he had received from the president of the Niagara Falls Hydraulic Power and Manufacturing Company, which letter, with its inclosures, was referred to us for report.

The Niagara Falls Hydraulic Power and Manufacturing Company represents that as the riparian owner it has the right to divert water from the Niagara River for the development of power, a right which it has been exercising for many years; that in the year 1896 this right was specifically recognized, declared and confirmed by the State of New York, but the quantity of water to be diverted was at the same time restricted to the amount which could be drawn through a canal 100 feet wide, flowing with a depth of 14 feet, an amount computed to be 9,500 cubic feet per second under the plans adopted for the works; that its works have been planned, and their construction nearly completed, with a view to the use of this full amount, costing over $5,000,000; that under recent legislation of Congress it is for the present restricted to the diversion of 6,500 cubic feet per second, which restriction, if made permanent, will subject it to heavy pecuniary loss; and that it is commonly understood that the United States and Great Britain are negotiating, or about to negotiate, a treaty affecting, among other things, the diversion of water from the Niagara River for the development of power. The company asks that its right to divert water to the extent of 9,500 cubic feet per second be protected and secured to it by a suitable provision in any treaty which may be made.

The situation is fairly stated by the company, and the request seems to us reasonable. It is consistent with the recommendations contained in our report of March 19, 1906, which read as follows, viz:—

'If the falls are to be preserved it must be by mutual agreement between the two countries. As a step in that direction we recommend that legislation be enacted which shall contain the following provisions, viz:—

'(a) The Secretary of War to be authorized to grant permits for the diversion of 28,500 cubic feet per second, and no more, from the waters naturally tributary to Niagara Falls, distributed as follows:

	Cubic feet.
Niagara Falls Hydraulic Power and Manufacturing Company	9,500
Niagara Falls Power Company	8,600
Erie Canal or its tenants (in addition to lock service)	400
Chicago Drainage Canal	10,000

'(b) All other diversion of water which is naturally tributary to Niagara Falls to be prohibited, except such as may be required for domestic use or for the service of locks in navigation canals.

'(c) Suitable penalties for violation of the law to be prescribed.

'(d) The foregoing prohibition to remain in force two years, and then to become the permanent law of the land, if, in the meantime, the Canadian government shall have enacted legislation prohibiting the diversion of water which is naturally tributary to Niagara Falls in excess of 36,000 cubic feet per second, not including the amounts required for domestic use or for the service of locks in navigation canals. It is assumed, however, that an understanding upon this subject would be reached by treaty.

'The object of such legislation would be to put a stop to further depletion of the falls, and at the same time inflict the least possible injury upon the important interests now dependent upon this water power. The amount to be diverted on the Canadian side has been fixed with a view to allowing to the companies on that side the amounts for which they now have works under construction, which are:—

	Cubic feet.
Canadian Niagara Power Company	9,500
Ontario Power Company	12,000
Electric Development Company	11,200
Niagara Falls Park Railway Company	1,500
Welland Canal or its tenants (in addition to lock service)	1,800

'One of the effects of such legislation would be to give Canada the advantage of diverting 7,500 cubic feet per second more than is diverted in the United States. The advantage is more apparent than real, since the power generated on the Canadian side will to a large extent be transmitted to and used in the United States. In the negotiation of a treaty, however, the point should be considered.'

These recommendations were not adopted by Congress without qualification. In the Act approved June 29, 1906, the quantity of water authorized to be diverted on the American side at this time is less than recommended, and it is only under certain contingencies that additional amounts may be diverted hereafter. The Act is a temporary measure designed to apply an immediate remedy to evils of which the final remedy must be found in a treaty. Congress did not finally deprive itself, or even the executive under certain contingencies, of authority to increase the amount. Whether the power to authorize the diversion of 9,500 cubic feet per second by the Niagara Falls Hydraulic Power and Manufacturing Company is ever to be exercised or not, it would seem wise for the United States to retain the power in making its agreements with Great Britain.

Yours very respectfully,

O. H. Ernst,
Brigadier-General, U.S. Army, Retired, Chairman.

George Clinton,
Member.

E. E. Haskell
Member.

The Secretary of War,
Washington, D.C.

Appendix D.

REPORT OF COMMISSION UPON THE CHICAGO DRAINAGE CANAL, DATED JANUARY, 1907.

(Printed in previous reports—See Page 529).

Appendix E.

[1051.]

EXTRACT FROM A REPORT OF THE COMMITTEE OF THE PRIVY COUNCIL, APPROVED BY THE GOVERNOR-GENERAL ON MAY 6, 1907.

On a memorandum dated 2nd May, 1907, from the Acting Minister of Public Works, stating that on several occasions representations by deputations, petitions, and otherwise, have been made to the Department of Public Works urging the nesessity of providing means for preventing the alleged damages caused to riparian owners by the overflowing of its banks by the Richelieu River;

That pursuant to the above representations a report has been prepared by the office of the Chief Engineer of the Department of Public Works (copy of Resident Engineer Michaud's report hereto attached), suggesting certain works as a means of stopping these annual floods.

The Minister further states that Parliament during the course of its last session provided an amount of $10,000 toward the commeneement of these works.

The Minister recommends that before a commencement is made, in view of a portion of the waters affeeted lying contiguous to the territory of the United States, a reference be had to the International Waterways Commission in order that the proposed improvement may have the careful consideration of that body.

The Committee submit the same for approval.

Rodolphe Boudreau,

Clerk of the Privy Council.

The Honourable Tl e Minister of Public Works.

Department of Public Works, Canada,

Resident Engineer's Office,

Montreal, April 7, 1902.

Sir: In compliance with your letter No. 824, of March 25, 1901, containing files Nos. 224136 and 224128, being a letter from Sir Wilfrid Laurier transmitting a letter from Mr. F. P. Demers, M.P., with a petition from the farmers of the parishes of Sabrevois, St. Sebastien, and St. Paul de l'Ile aux Noix, asking that the Chambly Manufacturing Company be not permitted to make further obstructions in the Richelieu River near Ste. Thérèse Island, at St. Johns, that the Vermont Central and Canadian Pacific Railways be forced to replace their present pile bridges built on stone piers, and charging me to carefully examine the situation and to make a complete report.

After a searching study of this question I have the honour to submit the following report, with a plan of the Richelieu River from the city of St. Johns to the St. Johns Rapids, showing surveys reduced to the extreme low water level, the profile and the projected works of improvement.

FLOODS.

For a number of years past, every spring during high water the Richelieu River overflows and floods a considerable area of land in the counties of St. John, Iberville, and Missisquoi, from St. Johns to Lake Champlain.

Last summer, assisted by Mr. Raoul de B. Corriveau, I surveyed all the flooded lands. The result of these surveys shows that a total of 23,180 acres are rendered unfit for culture by the long stay of the water. The water does not recede until from the 15th to the 30th of July, and it is then past sowing time. This land can only serve for the very poorest quality of pasture.

A plan from the surveys of the flooded lands shows the numbers of the official plan affected by the flood in the parishes of St. Athanase, Sabrevois, St. Sebastien, St. Georges de Henriville, in the county of Iberville; of Stanbridge, Clarenceville, St. Thomas, and St. Armand, in the county of Missisquoi; and of Lacolle, St. Paul de l'Ile aux Noix, in the county of St. John. The lands damaged in each county are as follows: St. John, comprising l'Ile aux Noix and other islands, 4,460 acres; Iberville, 6,563 acres, and Missisquoi, 12,357 acres in superficies.

VALUATION OF DAMAGES.

The farming lands in the flooded district are as good as can be found in the province of Quebec. The annual value of this land, which is at least $50 per acre, is reduced to $20 on account of the prolonged stay of the water, thus causing an annual loss of $701,400 to the proprietors.

CAUSES OF THE ANNUAL FLOODS.

The farmers of the district are unanimous in saying that the floods and the stay of the water increases every year, rendering all culture impossible. I have personally ascertained the truth of these statements by the fact that fields which were at one time cultivated are now deserted and covered with brush, and timber on the river decays by being soaked too long.

The first and principal cause of the increase of water is the constant cutting of timber and the clearing of the land on the shores of Lake Champlain, the Richelieu river, the South river which flows into this last one a little below Bay. In these open fields the water arising from the melting of the snow and l'Ile aux Noix, and of the River aux Brochets, which flows into Missisquoi the rain flows quickly to the lake through the ditches and the brooks, and raises its level to more than 7 feet above its low-water level, and as the Richelieu River, whose shores are very flat, is the only outflow for this enormous accumulation of water, it necessarily follows that the water rises and covers a large area of land, while in the woods the snow melts slowly and the water is partly evaporated and absorbed by the earth.

The second cause is the construction of the Chambly Canal jetty, on the west side of the river, starting from a few hundred feet below the Vermont Central Railway bridge to Chambly. The width of the river is decreased by the construction of this jetty by about 300 feet at the head of the St. John rapids and by 150 feet below the Canadian Pacific Railway bridge. As the depth at low water at this last place is only 2 feet by a width of 1,250 feet, giving a flowing section of 3,500 feet square (at low water), it is evident that a diminution in

width of 150 feet by an average depth of 2 feet, giving a flowing section of 300 feet, is appreciable and increases by about one-third the height and length of the flood.

The third obstruction is the construction of the two wing dams on each side of the river, as indicated on the annexed plan. These dams are 2 feet high at the head of the rapids and have the same level up to the mills.

The dams decrease the width of the river at the head of the rapids by 500 feet by an average height of 2 feet. Although part of the water retained by these dams flows through the mills when they are working, and the dams are submerged at high water by about 6 feet at the head of the rapids, they, nevertheless, diminish the flowing section at that place by one-tenth at high water, and increase both the flood and the stay of the water.

The fourth and last obstruction is the eel weir. This weir is from 4 to 5 feet high at the base and is built as indicated on the plan.

The weir is about 800 feet above the foot of the rapids, and as its head is 4 feet under the head of the rapids it does not constitute a serious obstacle. However, I am of the opinion that it delays and restrains the flow of the water and assists in prolonging the flood.

It is generally believed that the pile bridge of the Vermont Central Railway is the principal cause of these floods and their duration. I am not of that opinion, and I do not believe the bridge delays the flow of the water and prolongs the duration of the flood for the following reasons:

At the bridge the surface section of the river at low water is 7,553 feet from the shore of the Iberville side to the pier of the swinging bridge, and the surface from this pier to the Chambly Canal jetty form a total flowing section of 10,753 feet of surface. By deducting one-tenth for the obstruction caused by the piles of the bridge a net flowing section of 9,675 feet remains, while at the head of the rapids, as stated above, the surface of the flowing section is only 2,500 feet, without counting the obstruction caused by the dams of the mills. These comparisons are for low water only, but they are proportionate for high water; consequently this bridge has really no effect on the flow of the water.

HOW TO PREVENT THESE ANNUAL FLOODS.

The question of preventing these annual floods and to diminish their duration so as to allow the cultivation of the lands affected is not new. Exploration reports have already been made, as shown by the charter of the Hydraulic and Manufacturing Company of St. John and Iberville, which was incorporated by a statute of the Province of Quebec (50 Vic., chap. 48), and sanctioned May 18, 1887. Clause 2 of the charter states:

'The company shall have power to dredge and clean the Richelieu River between Jones', opposite to St. Johns City, and Ste. Thérèse mills wherever necessary to facilitate the flow of the river; to construct at the head of the rapids, between the cities of St. Johns and Iberville, a movable dam which could be opened completely at high water, leaving the water its free course until the danger of flooding the shore lands is past, and which could then be closed entirely or "in part", so as to retain the water at a sufficient height for the needs of the navigation without flooding the shore lands.'

And in clause 2: 'All lands thus improved by the work of the company shall be taxed in its favour, without registration, of a contribution or sum of money to the extent of $2 per annum for two years.'

Clauses 12 and 13 provide how the collection of this contribution, of $10 per acre, shall be made by the company.

These statutes are still in force, but the company never made any work.

After carefully taking the surroundings and levels, and making the necessary calculations for high and low water of the Richelieu River between the Vermont

Central Railway bridge and the foot of the Ste. Thérèse rapids, I have come to the conclusion that these annual floods can be prevented, and even in years when the water would be exceedingly high they would be of such short duration that they would not cause any damage by delaying the cultivation of the lands.

By the profile shown on the plan the average depth at low water at the Vermont Central Railway bridge is 7½ feet, or 108·5 under the datum; between the points 6 and 7 at the head of the St. John rapids the average depth is 2 feet and the level 104 under the datum; between the points 12 and 13 at the foot of the rapids the average depth is 3·3 feet and the level 199·70 under the datum. It is shown that these rapids form a natural dam 5·15 feet higher than the river bed, and the river being 300 feet narrower at this place, it follows that the large accumulation of water produced by the rapid melting of the snow and the rain must increase the level of the lake, the Richelieu River and its branches, and consequently produce these long floods.

The work to be done to obtain this result consists in removing the head of the St. John rapids by making a cut of 700 feet in width by a length of 4,900 feet and a depth of 4 feet 9 inches, as indicated by a red tint on the plan and profile. The flowing section, which is 2,500 feet at the head of the rapids, will be increased by this cut to 3,325 feet on the whole length of the rapids, thus giving a total flowing section of 5,825 feet. As the depth of the water at the head of the rapids is 7 feet during the floods, by enlarging the flowing section at this place the level would be lowered by 3 feet, taking in account the fact, for this lowering of the level, that the low ebb will be 2 feet lower at the beginning of the flood and that during the intervening periods the enlargement of this section will act as a constant drain, as much by its great flowing capacity as by the increase of current which it will produce.

Three hundred and two thousand three hundred and fifty cubic yards, composed of hard clay, the surface of which is covered with stones varying in size from one-half to 2 feet, will have to be removed. The removed matter can be deposited 10,000 feet below the foot of the rapids, where the river widens and has a depth of 12 to 15 feet.

I estimate the cost of this dredging at 20 cents per cubic yard on account of the stones and the difficulty to place the dredges, making an approximate expense of $160,470.

The mills, having no more power, and Mr. Duval's eel weir will have to disappear. I estimate the indemnity in these three cases at $20,000, making a total of $180,470.

Two dredges of the capacity of 500 to 600 cubic yards per day will be required to complete this work in two seasons.

MOVABLE DAM.

It is evident that if high water is lowered by removing the shoals at the head of the rapids, the low water will also be lowered in the lake and river. Consequently, this shoal will have to be replaced by a movable dam, which could be opened to allow the water to flow freely and then closed to retain the water 3 or 4 feet below high-water level, so as not to flood the shore lands.

This movable dam will be placed 7 feet below the Jones bridge, at right angle with the canal jetty, and will be 1,350 feet long. Considering that the ice is retained 1,300 feet above by the Vermont Central Railway bridge and does not pass this place, the pile construction could be built advantageously and cheaply. I propose the following construction:

Make a transversal cut in the river, for the dam, 25 feet wide and 5 feet deep; 8 feet above this cut place trestles every 15 feet, as indicated on the movable

dam plan herewith attached; the bonds will be in oak 8 by 10 inches and attached to the piles with 1-inch screwed bolts and iron washers of 3 inches by $\frac{5}{8}$-inch; a tenon of 8 by 4 inches and 6 inches long will be made in the head of each pile to receive a piece of oak 12 by 12 inches and 20 feet long, having mortises corresponding to the tenons; on these transversal pieces there will be longitudinal joists of 12 by 12 inches placed every 4 feet to receive a floor; an oak piece of 12 by 12 inches and of sufficient length to reach the bottom of the river from the top of the trestles will be placed vertically in front of each trestle and bolted to the two first piles; these oak pieces will receive and retain the stop planks; these will be 15 feet long, 12 by 12 inches in the center for one-third of the length, and 12 by 6 at each end; they will be placed horizontally one on top of the other to the height to which we desire to raise the water and attached at each extremity to the oak pieces of the trestles by iron Z-shaped braces; they will be put in place and removed with a steam crane placed on a car and rails.

In order to prevent erosion after the water will be raised 3 or 4 feet there will be a row of piles touching one another, sunk 8 or 10 feet and cut horizontally and even with the bottom of the river between each trestle, to receive and support the stop planks.

I estimate the cost of this movable dam at $40,000.

After the close of navigation in the fall the stop planks will be removed and placed on the head of the dam, thus leaving the river opened. We see that after removing the shoals forming the head of the St. John Rapids the water will be 3 feet below its actual low-water level in the river and the lake, and that it will take an enormous quantity of water to make up the difference, thus helping to decrease the floods. In July the stop planks will be replaced as fast as the water goes down, to keep it at the level wanted.

This movable dam will be a considerable advantage to navigation in the Richelieu River and the bays of Lake Champlain, where the water becomes very low in the summer, as the water will then be deep enough in the whole width of the river, and at the same time stop dredging which the Government is doing in the river from St. Johns to Lake Champlain, and which is estimated at $100,000. It will, moreover, allow to give more water to the Chambly Canal during navigation, and with certain improvements this canal could be made a 9-foot one.

I do not give here the power of resistance which the projected pile movable dam will offer. It would be going into long details. I will only say that I made calculations and that its power will be 100 per cent in excess of the required force.

If the Manufacturing Company of Chambly has obtained or obtains, as it asked, the permission to construct a permanent dam of 18 feet in height at the foot of the Ste. Thérèse Rapids, it will push back the water as far as or near the head of St. John Rapids at high water and render useless all work to give a free flow to the high water and prevent floods, unless the company is ordered to build a permanent dam of not more than 8 feet in height, with doors 6 feet in height, which could be opened during high water in the whole length of the dam, to be then closed and give the company the necessary power during the rest of the year. Otherwise, as stated above, all improvements become useless, for the following reason:—

The difference of level at high water between St. John and the projected dam of the company is 26 feet. At least 2 feet of water will pass over this dam at high water; and if we lower the head of the St. John Rapids by 4 feet, the level will be reduced by 2 feet for a distance of 8 miles, so that the dam of the company, by pushing back the water as far as St. John, will render this work useless.

But if for some reason or other the removing of the shoals at the head of the St. John Rapids is not to be done, I would recommend the construction of the

movable dam mentioned above. This construction would greatly improve navigation in the Richelieu River as far as the lake by giving a 10-foot channel by the width of the river; it would also give more water for the Chambly Canal and effect an economy of about $60,000 in dredging.

I have the honour to be, sir, your obedient servant,

J. B. Michaud, *Resident Engineer.*

Department of Public Works, Canada,
Resident Engineer's Office,
Montreal, January 22, 1907.

Sir,—In compliance with your telegram of the 19th instant I enclose herewith copy of my report of April 7, 1902, regarding the flooding of the Richelieu River, due to obstructions at St. Johns, Quebec.

Owing to the increased cost of labour and increased value of materials since the estimates were made, I beg to modify said estimates as follows:—

Dredging, $0.60 a cubic yard instead of $0.20, increasing cost of same to $90,700.

Movable dam, concrete, $12 a cubic yard instead of $8, increase in cost of iron $1,882, increase in cost of timber $1,000, in cost of labour not included above $5,000, the total cost of movable dam being thus increased to $92,500.

Other items, no increase.

New estimate cost of all the proposed improvements would thus be raised to $203,200.

I remain, sir, your obedient servant,

J. B. Michaud, *Resident Engineer.*

Eugene D. Lafleur, Esq.,
Chief Engineer, Public Works Department, Ottawa, Ontario.

Appendix F.

REPORT OF THE INTERNATIONAL WATERWAYS COMMISSION ON THE LOCATION OF THE BOUNDARY LINE BETWEEN THE UNITED STATES AND CANADA THROUGH LAKE ERIE.

(This report is already printed. See page 576.)

Appendix G.

[H. R. 25707. Fifty-ninth Congress, second session.]

A BILL to authorize the construction of dams, canals, power stations, and locks for the improvement of navigation and development of water power on the Saint Lawrence River at and near Long Sault Island, Saint Lawrence County, New York.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Michael H. Flaherty, Fred. F. Hyde, Henry H. Warren, Walter F. Wilson, and John C. Crapser, their successors and assigns, may hereafter erect, construct, maintain, operate, and use a dam or dams, canal or canals, reservoir or reservoirs, gates, sluices, trunks,

pipes, bulkheads, piers, flumes, abutments, and other works appurtenant thereto, and a bridge upon or in connection with said works, in or across the Saint Lawrence River, in the State of New York, or so much thereof as lies within the jurisdiction of the United States, and in and across the lands adjacent to said river, at such point or points upon or adjacent to the south shore of said river, near Long Sault Island, or Barnhart's Island, and upon the said islands, and between said islands or either of them and the shores of said river and Sheiks Island (but not across the international boundary line unless consented to by the Dominion of Canada), as the said Michael H. Flaherty, Fred. J. Hyde, Henry H. Warren, Walter F. Wilson, and John C. Crapser, their successors and assigns, may elect and the Secretary of War may approve, and also in and upon so much of the said river and the bed thereof as lies south of the international boundary line, independently or in connection with like works now erected or to be erected in so much of said river and the bed thereof as lies to the north or Canadian side of said international boundary line, and upon and adjacent to the northerly shore of said river, and said Michael H. Flaherty, Fred J. Hyde, Henry H. Warren, Walter F. Wilson, and John C. Crapser, their successors and assigns, may erect, construct, maintain, operate, and use power stations on or in connection with the said works, with all suitable structures, machinery, and other accessories for the development of water power and the generation, use, and transmission therefrom of electric energy and power to be derived from said Saint Lawrence River, subject to all and singular the conditions and provisions of an Act entitled 'An Act to regulate the construction of dams across navigable waters', approved June twenty-first, nineteen hundred and six, excepting that the actual construction of the works herein authorized shall be commenced within one year and completed within ten years from the date of approval hereof: Provided, That the said above-named persons, their successors or assigns, shall, coincidently with the construction of the said works, build at locations approved by the Secretary of War a lock or locks with its or their appurtenances, said lock or locks to be of such kind and size and to have such appurtenances and equipment as shall conveniently and safely accommodate all the present and prospective commerce of the Saint Lawrence River: Provided further, That the said works and their appurtenances shall be so designed, located, constructed, maintained, operated, and used, and the said lock or locks, with its or their appurtenances, shall be so designed, located, constructed, equipped, and maintained as to permit at all times during the season of navigation and at any stage of water the safe and convenient navigation of steamboats and other vessels and of rafts and barges through all that portion of the Saint Lawrence River affected by said works: Provided further, That detailed plans for the construction and operation of the said lock or locks shall be submitted to and approved by the Secretary of War before the commencement of construction of any portion thereof and the said lock or locks shall be constructed under the supervision of some engineer officer of the Army designated for that purpose, and that after the approval of the plans therefor no deviation therefrom shall be made without the prior approval of the Secretary of War of any such deviation: Provided further, That compensation shall be made by the said above-named person, their successors or assigns to all persons, firms, or corporations whose lands or other property may be taken, overflowed, or otherwise damaged by the construction, maintenance, or operation of the said works, in accordance with the laws of the State of New York, but the United States shall not be held to have incurred any liability for such damages by the passage of this Act: Provided further, That when said dam or dams and lock or locks and appurtenant works shall have been completed to the satisfaction of the Secretary of War, the said above-named persons, their successors or assigns, as the case may be, *shall convey to the United States, free of cost, title to all such lands as may be required for the construction and operation of said lock

or locks or approaches thereto, and shall grant to the United States free use of all such water power as may be necessary for operating such lock or locks: Provided further, That the United States shall at all times have the right to control the use of the said dam or dams and the level of the pool or pools formed thereby to such an extent as may be necessary to provide proper facilities for navigation.

Sec. 2. That the withdrawal of water from the Saint Lawrence River and the discharge of water into the said river for the purpose of operating the said power stations and appurtenant works shall at no time be such as to impede or interfere with the safe and convenient navigation of the said river by means of steamboats or other vessels or by rafts or barges: Provided, That said above-named persons, their successors or assigns, shall construct such suitable fishways as may be required from time to time by the Secretary of Commerce and Labour.

Sec. 3. That except as provided for below in this section said above-named persons, their successors or assigns, shall bear the entire cost of locating, erecting, constructing, maintaining, and operating the structures and appurtenances provided for in this Act: Provided, That the United States shall bear the cost of the supervision of the work by an engineer officer of the Army, as provided for in section one of this Act, and also the cost of maintaining and operating the lock or locks, with their appurtenances, after their completion and due acceptance by the Secretary of War: Provided further, That the said above-named persons, their successors or assigns, shall provide, in connection with such lock or locks and appurtenances, sufficient and suitable power for operating the same, as provided in section one of this Act, according to plans and specifications submitted to and approved by the Secretary of War.

Sec. 4. ** That the right to alter, amend, or repeal this Act is hereby expressly reserved.

Note.—The Chief of Engineers, United States Army, under date of February 23, 1907, recommended to the Rivers and Harbours Committee that section 1 be amended at the point marked * by inserting the following:

*"turn the said lock or locks over the United States ready for use and free of all expense, and said structures shall be and remain the sole and exclusive property of the United States, and the said persons, their successors or assigns, shall also"

Also, that section 4 be numbered 5, and a new section 4 be inserted as follows:

**"Sec. 4. That the consent of the proper authorities of the Dominion of Canada shall be obtained before the work herein authorized is commenced."

Appendix H.

Chapter 355.

AN ACT To incorporate the Long Sault Development Company, and to authorize said company to construct and maintain dams, canals, power-houses and locks at or near Long Sault Island, for the purpose of improving the navigation of the St. Lawrence river and developing power from the waters thereof, and to construct and maintain a bridge, and carry on the manufacture of commodities.

[Became a law, May 23, 1907, with the approval of the governor. Passed by a two-thirds vote.

The people of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Michael H. Flaherty, Frank S. Smith, Henry H. Warren, Walter F. Wilson, and John C. Crapser, and all such persons as are or may hereafter be associated with them, and their successors, are hereby constituted

a body corporate and politic by the name and style of the "Long Sault Development Company", for the purpose of erecting, constructing, maintaining, operating and using in connection with the Saint Lawrence river, a dam or dams, a canal or canals, a reservoir or reservoirs, and a power-house or power-houses and works appurtenant thereto, at or near Long Sault island, in the county of Saint Lawrence, and of erecting and constructing a lock or locks, and works appurtenant thereto, at or near the same place, all for the development of electrical power and energy, and the permanent improvement of navigation on the Saint Lawrence river at and above and below said place; and also of constructing and maintaining a bridge upon or in connection with said works, and of carrying on the manufacture of commodities with the said power.

2. Said corporation shall have power:

(1) To have perpetual succession;

(2) To have a common seal and alter the same at pleasure;

(3) To acquire, by grant, gift, purchase, devise, bequest, or other lawful means, and to hold and dispose of such property as its purpose shall require, subject to such limitations as may be prescribed by law;

(4) To appoint such officers and agents as its business shall require, and to fix their compensation;

(5) To make by-laws not inconsistent with any existing law, for the management of its property, the regulation of its affairs, the transfer of its stock, and the calling of meetings of its members;

(6) To borrow money and contract debts, when necessary, for the transaction of its business or for the exercise of its corporate rights, privileges or franchises, or for any other lawful purpose of its incorporation; and it may issue and dispose of its obligations for any amount so borrowed, and may mortgage its proprety and franchises to secure the payment of such obligations or of any debt contracted for said purpose, subject in all respects to the provisions of section two of the stock corporation law.

(7) Said corporation shall have all the other powers, privileges and franchises now or hereafter conferred by the general, stock and business corporations laws of the state of New York.

3. Said corporation shall have the right to erect, construct, maintain, operate and use all such dam or dams, canal or canals, reservoir or reservoirs, gates, sluices, trunks, pipes, bulkheads, piers, flumes, abutments, and other works appurtenant thereto, as may be proper or useful for the purpose of the development of water power, and of electrical power and energy therefrom, at such point or points upon or adjacent to the south shore of the St. Lawrence river, near Long Sault Island or Barnhart's island, and upon the said islands, or either of them, and between said islands, and between islands or either of them and the shores of the said river and Sheik's island (but not across the international boundary line unless consented to by the Dominion of Canada), as may be selected by said corporation, and also in and upon so much of the said river and the bed thereof as lies to the south of the international boundary line, at or near Long Sault island or Barnhart's island, either independently or in connection with like works now erected, or to be erected, in so much of said river and the bed thereof as lies to the north or Canadian side of said international boundary line, and upon and adjacent to the northerly shore of said river; and to erect, construct, maintain, operate and use a power-house, or power-houses, and conductors, cables, wires, insulators and other appliances in connection with the said works for the development of electrical power and energy; and also to take and use the waters of said river at and above the points of location of said works heretofore authorized, and to construct and maintain upon, over and in connection with said dam or dams and other works, a bridge or bridges, across or partly across the Saint Lawrence river, with the approaches thereto, for the use of foot passengers, animals and vehicles, and to charge reasonable rates of toll for passage

thereon; the said rights being granted upon the express condition that said corporation shall make just compensation to all persons injured by the exercise of the rights and privileges heretofore granted, and that said corporation shall also erect and construct a lock or locks as may be required by the United States of America, and shall provide electrical power or energy for the maintenance, operation and use of said lock or locks, free of charge, and shall in all other respects perform, fulfil and abide by all and singular the conditions and provisions of this act, and also of any act of the congress of the United States relating thereto, and also upon the condition that the rights hereby granted shall never be so used as to impair or obstruct the navigation of the Saint Lawrence river, but, on the contrary, that such navigation shall be preserved in as good condition as, if not better than, the same is at present, regard being always had to the amount of the natural flow of water in said river as affecting its navigability from time to time.

4. After the Congress of the United States shall authorize the construction of dams, locks and canals hereby authorized and after the payment by said corporation into the treasury of the state of the fixed sum of ten thousand dollars the commissioners of the land office shall, upon application of said corporation, grant unto it the title and interest of the people of the state in and to lands under the waters of the Saint Lawrence river to be covered or occupied by said works and locks and power-houses, provided, however, that any of the lands of the state which may be so conveyed to said corporation shall be forfeited and title thereto shall revert to the state unless the same are actually used by said corporation and covered by its dams, canals, reservoirs, gates, sluices, trunks, pipes, bulkheads, piers, flumes, abutments or other works appertaining thereto, or are necessary to the enjoyment for said purposes of any lands so used or covered, within fifteen years from the conveyance thereof by the commissioners of the land office to said corporation under authority of this act, and in consideration of the conveyance so made under the authority of this act, as well as for the rights and privileges hereby granted the said corporation in addition to the payment aforesaid shall pay into the treasury of the state for the year nineteen hundred and ten the fixed sum of fifteen thousand dollars, and for the year nineteen hundred and eleven the fixed sum of twenty thousand dollars. For each year after nineteen hundred and eleven the said corporation shall pay at the following rates upon the average amount of electrical horse power generated during such year under authority of this act, that is to say: Upon all amounts up to twenty-five thousand electrical horse power, at the rate of seventy-five cents per horse power; upon all amounts in excess of twenty-five thousand electrical horse power and up to one hundred thousand electrical horse power, at the rate of fifty cents per horse power; upon all amounts in excess of one hundred thousand electrical horse power, at the rate of twenty-five cents per horse power. In case said corporation shall generate or develop water power as mechanical power, without transmitting the same into electrical power, then for so much of said water power as shall be so generated or developed, payment shall be made at the above mentioned rates per mechanical horse power.

In determining the average amount of electrical horse power generated and the average amount of mechanical horse power generated or developed in any year, for the purpose of determining the amount to be paid to the state, no day nor hour during which the works of said company are not in substantial operation shall be included in the total time for which such average is to be determined as the average for the year. In case the amount which would be payable at the rates aforesaid for either of the years nineteen hundred and ten or nineteen hundred and eleven, upon the average amount of power generated during such year shall exceed the fixed sum hereinbefore required to be paid for such year, the said corporation shall also pay the amount of any such excess; and if for any year after nineteen hundred and eleven the amount payable at rates afore-

said is less than twenty-five thousand dollars, then said corporation shall pay for such year the sum of twenty-five thousand dollars instead of the amount that would be payable at the rates aforesaid. Said amounts for each year shall be payable on or before the first day of February in the following year, and within ten days before the same shall become payable the said corporation shall deliver to the state engineer and to the state treasurer a verified statement showing the average amount of electrical horse power generated, and the average amount of mechanical horse power generated and not transmitted into electrical horse power by said corporation under the authority hereby granted, during the year ending on the thirty-first day of December next preceding the date of making such statement. The books or other records of said corporation, showing the amount of power so generated, and its works and plant shall at all times be open to inspection and examination by the state engineer for the purpose of verifying or disputing the correctness of any such statement.

The state engineer may prescribe the form of records to be kept by said corporation, and the character of measuring instruments and devices to be used and a reasonable standard of the accuracy thereof and the methods by which said accuracy is to be determined. Said corporation shall keep such records and shall provide and use such instruments and devices and have the same tested accordingly.

If any dispute shall arise in respect to the amount payable for one year at the rates aforesaid the court of claims shall have jurisdiction to hear and determine the same.

In case the said corporation shall failto pay any amount due hereunder within sixty days after the same is payable as herein provided, in addition to any other remedies which may exist by law, the rights and privileges hereby granted may be forfeited.

The payments above specified are based upon the assumption that the said corporation under the authority of this act, subject only to the lawful control of the United States Government, may use for the purpose herein specified, at the places herein mentioned all of the waters of the St. Lawrence River south of the international boundary line, but in case said corporation shall at any time be compelled to make any payment to the Dominion of Canada or the Province of Ontario for the use by said corporation of any portion of said water to generate power as authorized by this act, said corporation shall be entitled to an equitable readjustment of the rate of compensation to be paid to the state for that portion of the said water for the use of which said corporation shall be compelled to make payment to said dominion or province. Such readjustment shall be made by arbitrators, one of whom shall be appointed by the said corporation and one by the governor of the state within thirty days after the receipt by him of written notice of such appointment by said corporation, and in case of their failure to agree the two said arbitrators shall choose an umpire. The decision of the arbitrators, or of the umpire, shall be made in writing, in duplicate, one copy shall be filed with the state treasurer and one delivered to the said corporation; such decision shall be final and binding on both parties, and from and after a date to be fixed therein, payments shall be made in accordance therewith, and pending such decision payments shall be made for each year at the rates aforesaid.

5. Said corporation may at any time, with the consent of the holders of at least two-thirds in amount of its capital stock at the time outstanding, given in writing or at a meeting of such stockholders duly called for that purpose, sell or convey all or any portion of its property and assets, and the franchises and rights appurtenant thereto, upon such terms as may be consented to as aforesaid, but subject always to all the conditions and provisions of this act.

6. The existence of said corporation shall be perpetual.

7. The capital of said corporation shall be one million dollars, divided into ten thousand shares of the par value of one hundred dollars each; but said corporation shall not begin business until two hundred and fifty thousand dollars, par value, of the capital stock shall have been actually subscribed and paid for in cash, nor until the organization tax provided for by the general laws of the State of New York shall have been paid to the state treasurer; and upon any increase of said capital stock such tax upon such increase shall also be paid.

8. The number of directors of said corporation shall be five. Said directors shall hold office for the term of one year after their election and until their successors are elected and qualified. Michael H. Flaherty, Frank S. Smith, Henry H. Warren, Walter F. Wilson and John C. Crapser shall be the directors of said corporation for the first year and until their successors are elected and qualified. The first election shall be held on the first Monday after the third Thursday of February, in the year nineteen hundred and eight. Any vacancy in the board of directors occurring before the first election shall be filled by vote of the remaining directors. The number of directors may be increased as provided by law.

9. The said corporation shall begin the work of constructing its dam pursuant hereto within one year after the Congress of United States shall authorize the construction of dams, locks and canals hereby authorized, and in case such construction shall not be so begun the grants, rights and privileges hereby granted may be forfeited.

10. This act, and all the terms, conditions, and provisions thereof, shall apply to the successors and assigns of the incorporators named in the first section hereof.

11. This act shall take effect immediately.

Appendix I.

Prime Minister's Office, Canada,

Ottawa, October 12, 1907.

My Dear Gibbons,—I understand that about the 23rd of this month there is likely to come before you and the other members of the Waterways Commission a question relating to the possible development of power at or near Mille Roches, or Cornwall, to be developed in conjunction by a Canadian and an American company. Application has been made to the Minister of Railways and Canals by the Canadian Company, the St. Lawrence Power Company, and the Minister has instructed the Chief Engineer to examine into and report to us upon that application, which examination will take place at the earliest possible date.

It seems to me that it would be inadvisable for your commission to deal with the matter until the Department of Railways and Canals is fully seized of it. I will be obliged to you if you will bear this in mind in your proceedings.

Yours very sincerely,

WILFRID LAURIER.

Geo. C. Gibbons, Esq., London, Ontario.

APPENDIX K.

INTERNATIONAL WATERWAYS COMMISSION,

OFFICE OF CHAIRMAN, AMERICAN SECTION.

ROOM 427 MILLS BUILDING ANNEX, SEVENTEENTH AND G STREETS, N.W.

WASHINGTON, D. C., November 6, 1907.

SIR,—On behalf of the American section of the International Waterways Commission, I have the honour to transmit herewith a copy of an extract from a report of the Committee of the Privy Council, approved by the Governor General of Canada on the 6th May, 1907, which refers questions relating to the Rainy River to the International Waterways Commission; also a copy of an extract from a report of the Committee of the Privy Council, approved by the Governor General on the 9th May, 1907, which refers questions relating to the River St. John to the same commission. In the first case the extract was accompanied by the report of an engineer, and in the second case by numerous documents. These are not now forwarded.

The American section has some doubt as to its jurisdiction over questions relating to the Rainy River, and requests instructions as to whether it shall consider them.

In view of the fact that provision has been made by law for a separate commission to consider questions relating to the River St. John, it has little doubt as to its own jurisdiction over that river, but in deference to the Canadian government it submits the matter for the consideration of higher authority.

Yours very respectfully,

O. H. ERNST,

Brigadier-General, U. S. Army, Retired,

Chairman of American Section, International Waterways Commission

The Honourable SECRETARY OF WAR,

Washington, D. C.

EXTRACT FROM A REPORT OF THE COMMITTEE OF THE PRIVY COUNCIL, APPROVED BY THE GOVERNOR GENERAL ON MAY 6, 1907.

On a memorandum dated May 2, 1907, from the Acting Minister of Public Works, stating that, in order to improve the navigation of the Rainy River, a navigable stream forming part of the boundary between the Province of Ontario and the state of Minnesota, in which the existence of two rapids render the navigation difficult and dangerous, the Chief Engineer of the Department of Public Works was requested to cause an examination and report to be made. In this report Mr. J. W. Fraser strongly recommends the construction of a dam at the foot of Long Sault Rapids, a section of which will abut on American territory. This dam, built of timber, would raise the water to a sufficient height to obliterate both Manitou and Long Sault Rapids, which interrupt the navigation of the river about the middle of its course.

The Minister further states that Parliament at its last session provided an amount of $50,000 toward the commencement of this work.

SESSIONAL PAPER No. 19a

The Minister, in view of the Rainy River being an international stream, recommends that before any action is taken the question of its improvement be submitted to the International Waterways Commission for consideration and report.

The committee submit the same for approval.

RODOLPHE BOUDREAU,
Clerk of the Privy Council.

EXTRACT FROM A REPORT OF THE COMMITTEE OF THE PRIVY COUNCIL, APPROVED BY THE GOVERNOR GENERAL ON MAY 9, 1907.

On a memorandum, dated May 7, 1907, from the Acting Minister of Public Works, submitting that the Grand Falls Power Company (Limited) was chartered by an Act of the Provincial Government of New Brunswick (5 Edward VII, in 1905), the company subsequently applying to the Governor General in Council on January 5, 1906, for permission to construct hydraulic works on the River St. John.

To this application, however, strong protests were opposed:

Firstly, By the Madawaska Log Driving Company and the St. John River Log Driving Company, largely interested in the navigation of that stream at that special point and largely controlling the log driving operations on the river. The objections of the said log driving companies are given in detail more particularly in paragraph 3 of Mr. Resident Engineer Shewen's report and in the different documents attached hereto, and from which copies it will also be seen that an agreement was finally arrived at between the said log driving corporations and the Grand Falls Power Company.

The Canadian Pacific Railway Company also objected to the granting the permission sought for by the applicants, for the reason that the raising of the water near their bridge at that place will render the repairs to that structure very difficult and much more expensive.

Lastly, the Grand Falls Water Power and Boom Company, incorporated by chapter 77 of the Acts of the Dominion of Canada, passed on the 22nd of July, 1895, claim that they have acquired lands, mill privileges, water power, right of flowage, etc., and that the construction of the works proposed by the Grand Falls Power Company (Limited) will practically destroy their privileges.

The river St. John being a boundary stream, works affecting its navigation are of international importance, and for that reason would come more properly under the jurisdiction of the International Deep Waterways Commission.

The Minister, therefore, recommends that authority be given to refer the application of the Grand Falls Power Company (Limited) and of the protests lodged against said application to the International Deep Waterways Commission for their examination and report.

The committee submit the same for approval.

F. K. BENNETTS,
Assistant Clerk of the Privy Council.

The Honourable the MINISTER OF PUBLIC WORKS.

FOURTH PROGRESS REPORT OF THE CANADIAN SECTION.

REPORT TO DECEMBER 31, 1907.

OTTAWA, March 9, 1908.

Honourable WILLIAM PUGSLEY,
Minister of Public Works,
Ottawa, Ont.

MR. MINISTER,—The Canadian members of the International Waterways Commission have the honour to submit the following progress report covering their work for the calendar year ending December 31, 1907.

Dr. W. F. King, a member of the commission since its organization, having resigned, Mr. W. J. Stewart, the Dominion Hydrographer, was appointed in his place.

CHICAGO DRAINAGE CANAL.

The commission during the year, agreed upon a joint report with regard to the diversion of water from Lake Michigan by the Chicago Drainage Canal, which will be found at page 529 of this volume. The commission have agreed upon the following recommendations:

The waters of Lake Michigan in the United States, the waters of Georgian bay in Canada, and the waters of Lake Superior, partly in the United States and partly in Canada, all form sources of supply to the Great Lakes system, finding their way by the St. Lawrence River to the sea. All are interdependent and there can be no diversion from any of them without injury to the whole system. By Article XXVI of the Treaty of 1871 'navigation of the River St. Lawrence, ascending and descending from the forty-fifth parallel of north latitude where it ceases to form the boundary between the two countries, from, to, and into the sea, shall forever remain free and open for the purposes of commerce to the citizens of the United States, subject to any laws and regulations of Great Britain, or of the Dominion of Canada, not inconsistent with such privileges of free navigation.' It is desirable that in any treaty arrangement the waters of Lake Michigan, Georgian bay, and all other waters forming part of the Great Lakes system should be declared to be 'forever free and open for the purposes of commerce' to the citizens of the United States and the subjects of His Britannic Majesty, subject to any laws and regulations of either country, and not inconsistent with such privileges of free navigation.

The preservation of the levels of the Great Lakes is imperative. The interest of navigation in these waters is paramount, subject only to the right of use for domestic purposes, in which term is included necessary sanitary purposes. In our report of November 15, 1906, upon the application of the Minnesota Canal and Power Company to divert certain waters in Minnesota, we recommended, among other things, 'that any treaty which may be entered into should define the uses to which international waters may be put by either country without the necessity of adjustment in each instance, and would respectfully suggest that such uses should be declared to be (*a*) uses for necessary domestic and sanitary purposes; (*b*) service of locks for navigation purposes; (*c*) the right to navigate.' It is our opinion that so far as international action is concerned a treaty provision of that kind is all that is required in this case We accordingly renew our recommendation of November 15, 1906, just quoted.

A careful consideration of all the circumstances leads us to the conclusion that the diversion of 10,000 cubic feet per second through the Chicago river will, with proper treatment of the sewage from areas now sparsely occupied, provide for all the population which will ever be tributary to that river, and that the amount named will, therefore, suffice for the sanitary purposes of the city for all time. Incidentally it will provide for the largest navigable waterway from Lake Michigan to the Mississippi river, which has been considered by Congress.

We therefore recommend that the government of the United States prohibit the diversion of more than 10,000 cubic feet per second for the Chicago Drainage Canal.

Following this report, the Secretary of War of the United States, under date of March 14, 1907, declined to grant a permit, for which application had been made by the trustees of the Sanitary District at Chicago, to reverse the flow of the Calumet river. The board, nevertheless, at its session of September 18, 1907, decided to proceed with the construction of the proposed diversion channel, but to first give 'notice of its intention so to do to the Secretary of War and to the Attorney-General that they may, if they see fit, take such steps as they think proper to protect the rights, if any, of the General Government in the premises before the expenditure by the district of any considerable portion of the eight or ten millions of dollars necessary to construct the said channel.' They commenced work on a small scale in October, 1907, as a matter of form, whereupon, at the request of the War Department, the Department of Justice instituted injunction proceedings which are now pending.

The issue raised is one of the greatest moment. If the level of the Great Lakes system is to be maintained, the preservation of the same must necessarily depend upon the joint action of the two governments, as the withdrawal of water from Lake Michigan, in the United States, Georgian bay in Canada, or elsewhere in either country, must necessarily be injurious to the whole system.

Vast interests are involved. The amount by which the mean level will be lowered by the discharge of 10,000 cubic feet now authorized through the Chicago Canal, is estimated at about six inches in Lake Huron and Michigan, about five inches in Lake Erie and about four inches in Lake Ontario. Any further diversion would mean the necessary expenditure of a very large amount of money to restore depths in harbours and to maintain a uniform draught of fourteen feet in our canal system.

The issue is not one between ourselves and citizens of the United States. The Lake Carriers' Association, representing a great United States investment on these lakes, strongly protests against further diversions, other than those which are absolutely essential for sanitary purposes. Our interests are small compared with theirs, but, in the not very distant future, the development of our Northwest will materially increase our interest in maintaining this great highway, without which such development would not be possible. Vast as the traffic is now, what man can tell to what proportions it will reach in another twenty-five years, or what interests will then be involved?

It will be noticed that the commission find that it is desirable that 'in any treaty arrangement the waters of Lake Michigan and Georgian bay and all other waters forming part of the Great Lakes system should be forever open, for the purposes of commerce, to the citizens of the United States and the subjects of His Britannic Majesty to any laws and regulations of either country not inconsistent with such privileges of free navigation.'

By the treaty of 1871, the St. Lawrence river in Canadian territory was declared to be open and free forever to the citizens of the United States for the purposes of commerce. As set forth in the report, the whole system of waterways forming the Great Lakes system are interdependent and there should be a common right of user of the whole.

The conflict at Chicago shows the absolute necessity of some treaty arrangement for the preservation of the system and the adoption of certain principles which will control its use. Here we have a vast expense of navigable water, partly in one country and partly in the other, inseparable and indivisible on national lines. Neither country has any right of property in it and of necessity its use must be in common. It follows, therefore, that such use must be governed and controlled by some joint body. The present International Waterways Commission was created at the suggestion of the United States government, the Congress of which passed and approved on June 13, 1902, of an Act containing the following provision:—

The President of the United States is hereby requested to invite the government of Great Britain to join in the formation of an international commission, to be composed of three members from the United States and three who shall represent the interests of the Dominion of Canada, whose duty it shall be to investigate and report upon the conditions and uses of the waters adjacent to the boundary lines between the United States and Canada, including all the waters of the lakes and rivers whose natural outlet is by the River St. Lawrence to the Atlantic Ocean, also the maintenance and regulation of suitable levels, and also upon the effect upon the shores of these waters and the structures thereon, and upon the interests of navigation by reason of the diversion of these waters from or change in their natural flow; and, further, to report upon the necessary measures to regulate such diversion, and to make such recommendations for improvements and regulations as shall best subserve the interests of navigation in said waters. The said commissioners shall report upon the advisability of locating a dam at the outlet of Lake Erie, with a view to determining whether such dam will benefit navigation, and if such structure is deemed advisable, shall make recommendations to their respective governments looking to an agreement or treaty which shall provide for the construction of the same, and they shall make an estimate of the probable cost thereof.

This Bill was enacted because of the manifest necessity of some joint regulation and control. Your commission thought it expedient to first establish principles governing the use and diversion of boundary waters. Once proper principles have been agreed upon, their application by a permanent board must necessarily lead to uniform course of action, whereas if special matters are dealt with by special commissions, all manner of inconsistent conclusions might and likely would be arrived at. Once principles are agreed upon, and consistently applied, neither country will obtain any advantage. The commission by their various reports made suggestions and recommendations, from which the following conclusions were drawn:—

'1. The Great Lakes system, including Lake Michigan and Georgian bay, should be made a common highway for the purposes of navigation to the people of both countries.

'2. The right of either country with respect to such waters is the right of user only.

'3. The primary right of user is for domestic uses (including necessary sanitary purposes) and the services of locks and navigation canals.

'4. Subject to these uses, the use for navigation shall be paramount to all others.

'No diversion of these waters shall be permitted to the injury of navigation interests, save such diversions as are necessary for the preservation of the public health(sanitary purposes and domestic use) and service of locks of navigation canals.

'6. Where temporary diversions of such waters without injury to the interests of navigation are possible, they should be permitted so that each country, so far as is practicable, shall receive an equal benefit. This principle is

applicable to diversions for power purposes in the St. Marys and the St. Lawrence rivers.

'7. As to streams which cross the international boundary, no diversion of such streams or their tributaries should be permitted in either country so as to interfere with the natural flow thereof to the injury of private or public rights in the other country; nor should any obstruction be permitted in such streams in one country to the injury of public or private rights in the other.

'8. In Niagara river, diversions would not interfere with navigation, but there is a special consideration, the preservation of the scenic beauty of the falls, was brought to play. It was found, however, possible to divert about double the quantity of water on the Canadian side to that possible on the other side, without material injury to the scenic effect.

'9. The commission have not, for lack of jurisdiction, suggested any principle governing the use, for irrigation purposes, of waters which cross the international boundary, but some principle should be adopted which would have general application. We respectfully submit that all the principles so far adopted by the commission commend themselves as worthy of adoption.'

The boundary line between these two countries extends across the continent. For a great distance an imaginary line is drawn through boundary waters; elsewhere numerous streams cross and sometimes recross the international boundary. The increased value of water for power and irrigation purposes has given rise to new questions which must be met and settled in some way.

That can be done effectively by a treaty arrangement between the two countries, as only in that way can joint federal jurisdiction be with certainty asserted. Special commissions, which are the outcome of local disputes, are necessarily partial. The commissioners are advocates. A permanent board removed from local prejudice would apply the principles impartially and should be provided for in any treaty arrangement.

INTERNATIONAL BOUNDARY IN LAKE ERIE.

During the year the joint commission have made a report dealing with this matter, which will be found at page 590 of this volume. The matter was referred to your commission by direction of the Secretary of State of the United States with a view to having 'the exact internnational water boundary line on Lake Erie marked by buoys,' thereby enabling fishermen to readily ascertain the location of the boundary line and also to ascertain whether the United States and Canadian charts of the locality agreed as to the distance to be logged from the gas buoy at Erie, Pennsylvania, to the boundary on the usual fishing ground outside Long point.

In the report referred to above, will be found a full account of the 6th article of the Treaty of Ghent, and the recommendations made by the commission.

No authority has yet been given to the commission to proceed further with the matter.

RICHELIEU RIVER.

Under the direction of the Department of Public Works, a report was prepared in 1902 upon the subject of damage by over flow of the Richelieu river and a plan was submitted for correcting the evil. At its last session, Parliament appropriated $10,000 for the proposed works, which would be wholly within Canadian territory, but, inasmuch as they might affect the interests of the United States or of its citizens on Lake Champlain, our government referred the matter to the International Waterways Commission. The question was considered by the commission as a whole and dealt with by passing the following resolution:—

'Whereas certain valuable lands in the valley of the Richelieu river, the outlet of Lake Champlain, are subject to damage by overflow; and

'Whereas a plan for the reclamation of said lands, submitted by Resident Engineer J. B. Michaud, April 7, 1902, to the Canadian government, was referred by that government to the International Waterways Commission under the date of May 6, 1907; and

'Whereas the international question involved relates only to the effect of the proposed works upon the interests of the United States or of its citizens upon Lake Champlain; and

'Whereas the average level of Lake Champlain is 96·1 feet above tide water, New York, and the monthly mean level during floods is about 100.

'Resolved, That it is the opinion of the International Waterways Commission that the works proposed can be constructed without injury to the interests of the United States or its citizens upon Lake Champlain, provided a movable dam be constructed at St. Johns, and so operated that the flood waters of Lake Champlain shall be allowed to rise to a monthly mean level of 97 and the level of the lake shall hereafter be maintained at or above 95.'

POWER DEVELOPMENT NEAR LONG SAULT ISLAND.

As stated in a previous memorandum the application of Mr. Smith L. Dawley for a permit to construct works in the River St. Lawrence near Long Sault island was refused.

GRAND FALLS POWER COMPANY, LIMITED, RIVER ST. JOHN.

As stated also in a previous memorandum, the Canadian Government, by Order in Council, dated May 9, 1907, referred to the commission the application of the Grand Falls Power Company, Limited, for permission to construct hydraulic works on the River St. John, N.B. The United States section, having doubt as to its jurisdiction over the question, have requested instructions from the Secretary of War, before proceeding to consider the subject-matter of this reference.

POWER WORKS ON THE ST. LAWRENCE RIVER AT OR NEAR BARNHART ISLAND.

A Bill was introduced into Congress, but not passed, at its last session, to authorize construction, maintenance, operation and use of dams, canals, reservoirs, &c., in or across the St. Lawrence river, in the State of New York, or so much thereof as lies within the jurisdiction of the United States, and in and across the lands adjacent to the said river, at such point or points, upon or adjacent to the south shore of the said river, near Long Sault and Barnhart islands, and upon the said islands and between the said islands, or either of them, and the shores of said river and Sheek island (but not across the international boundary line, unless consented to by the Dominion of Canada), subject to the approval of the Secretary of War of the United States. A copy of the said Act is to be found at page 517 of this volume. It will be seen that section 4 provides:—

'That the consent of the proper authorities of the Dominion of Canada should be obtained before the work herein authorized is commenced.'

The Long Sault Development Company was incorporated by the State of New York on May 23, 1907, for the purpose of proceeding with these works. A Canadian company, known as the St. Lawrence Power Company, has been formed to act in conjunction with the United States company and both joined in an application to our commission for approval of their plans.

The St. Lawrence is not, at this point, navigable for vessels in general, but has been used, in passing down the river, by the Richelieu and Ontario Navigation Company's steamers continually and by small pleasure boats and for transport of timber rafts. The passage up is by way of the Cornwall canal. The proposed works involve the construction of dams across South channel (south of Long Sault Island) across the main channel between Long Sault and Barnhart island

and across the east end of Little river between the north side of Barnhart island and the Cornwall canal. In addition to these dams it is proposed to move lock 21, Cornwall canal, from its present position to the vicinity of lock 20, to deepen and improve Little river and to construct a lock in South channel.

The commission have adopted the principle that no development would be permitted by the diversion of boundary waters for power purposes to the injury of navigation interests, but, where such developments are possible without interferenee with the interests of navigation, then they should be permitted, and, as far as practicable, in such a way that each country would be equally benefitted.

The matter was brought before the commission at a meeting in Toronto when representatives of both power companies and their experts were present and explained the proposal. The minutes of the public hearing will be found in Appendix A. They urged that a large development of 50,000 horse-power and over could be obtained by the improvement suggested, and their experts contended that, instead of being an impediment to navigation, the proposed changes would much improve the conditions in that regard. The issues involved were, in our opinion, of a most serious character, and the Canadian section decided to call a special meeting in Montreal at which a public hearing would be given to all parties interested.

That meeting was held on November 6, in the Board of Trade rooms. The minutes of that meeting will be found in appendix B. Since that meeting, protests have been received against the allowance of the proposed works from the council of the Montreal Board of Trade, who urged among other things:—

'That in the case of a mighty river like the St. Lawrence, it is difficult, if not impossible for engineers to forecast the actual effect of entirely damming its swift flowing waters, and that there is a general conviction among the river-side population above Cornwall that the proposed works would cause such an overflow into the surrounding country as would involve damage to the extent of many millions of dollars, and your memorialists believe that they would also render useless some existing water powers in that vicinity.

'That the proposed damming of the river channels would, of course, prevent all boats shooting the Long Sault rapids, the finest rapids in the river, and that the delay which the passage through the canal would cause, would render it impossible for boats to travel through the Thousand islands by daylight and reach Montreal the same evening, and thus two of the chief attractions for passenger travel on the St. Lawrence trip would not be available, with the result that the country would lose the large tourist traffic which is a source of profit to the river steamers and to the places visited.

'That while the promoters of the scheme claim that the interests of commercial navigation would not suffer were it adopted, as cargo boats do not run the rapids, the rafting business seems to have been ignored in this connection.

'That it is estimated that the rafts which pass down the river in each season contain over 300 cribs of timber and that were these cribs forced to pass through a canal instead of shooting the rapids, much time would be lost, and they would, moreover, by blocking the canal, seriously interfere with other traffic.'

The Shipping Federation of Canada also object on the following, among other grounds:—

'That said dams would completely block the river so far as navigation is concerned and necessitate the vessels and rafts that use the river being diverted to the already congested canal, thereby seriously interfering with the present conditions of navigation.

'That any scheme that would place the control of the waters of the St. Lawrence river in the hands of private corporations would, in the opinion of this federation, be giving away a national heritage. At present there is, at times, congestion in our canals, and to transfer the passenger boats and the rafts,

would further increase the present delays that take place in getting the freight to the ports of Montreal, Quebec, Three Rivers and other ports in the lower St. Lawrence.

'3. That the canal and river system we hold, should not be interfered with even in the slightest degree. We have 72½ miles of canals, extending from (but not taking in) Sault Ste. Marie, by the Welland to the St. Lawrence, on which the government have expended eighty millions of dollars, and the total tonnage passing through these canals in 1903 amounted to over 1,600,000 tons, showing the magnitude of the commerce which is now using the canals and seeking Montreal as an export point.'

The Dominion Marine Association also protest upon the ground that:

'The said proposals include the construction of dams across the St. Lawrence river from the south shore to the foot of Long Sault island, from the said island to Barnhart island, and from that island to the Canadian shore, which dams will completely block the river, so far as navigation is concerned, and will necessitate passage up and down streams in all cases by way of locks.

'Vessels now enjoy the right of free navigation down stream in the channel north of Long Sault island, and south channel is also used for transportation down stream of rafts of timber of great value.

'The enforced lockage of these vessels and rafts and the enforced construction of the rafts in sections of suitable size for lockage, as well as the delays to be suffered during the period of construction of the proposed works, would very prejudicially affect not only the immediate interests involved, but also all other vessels which have to share the facilities for lockage.

'If the proposed works are built, the breaking of a dam or disabling of one or more locks, might completely bar all navigation for a considerable time, cut off the passage of rafts, and prevent even light vessels and barges from carrying the produce of the west down stream in the free channels, as has been done in the past.

'The St. Lawrence channels in question are part of the great natural highway from the Great Lakes to the sea, and it appears contrary to reason to oppose any obstacles or barriers whatever in the way of their free navigation, and utterly preposterous to subject these navigable waters, the heritage of the people, to the direct or indirect control of private or foreign corporations.'

And conclude by resolution, as follows:—

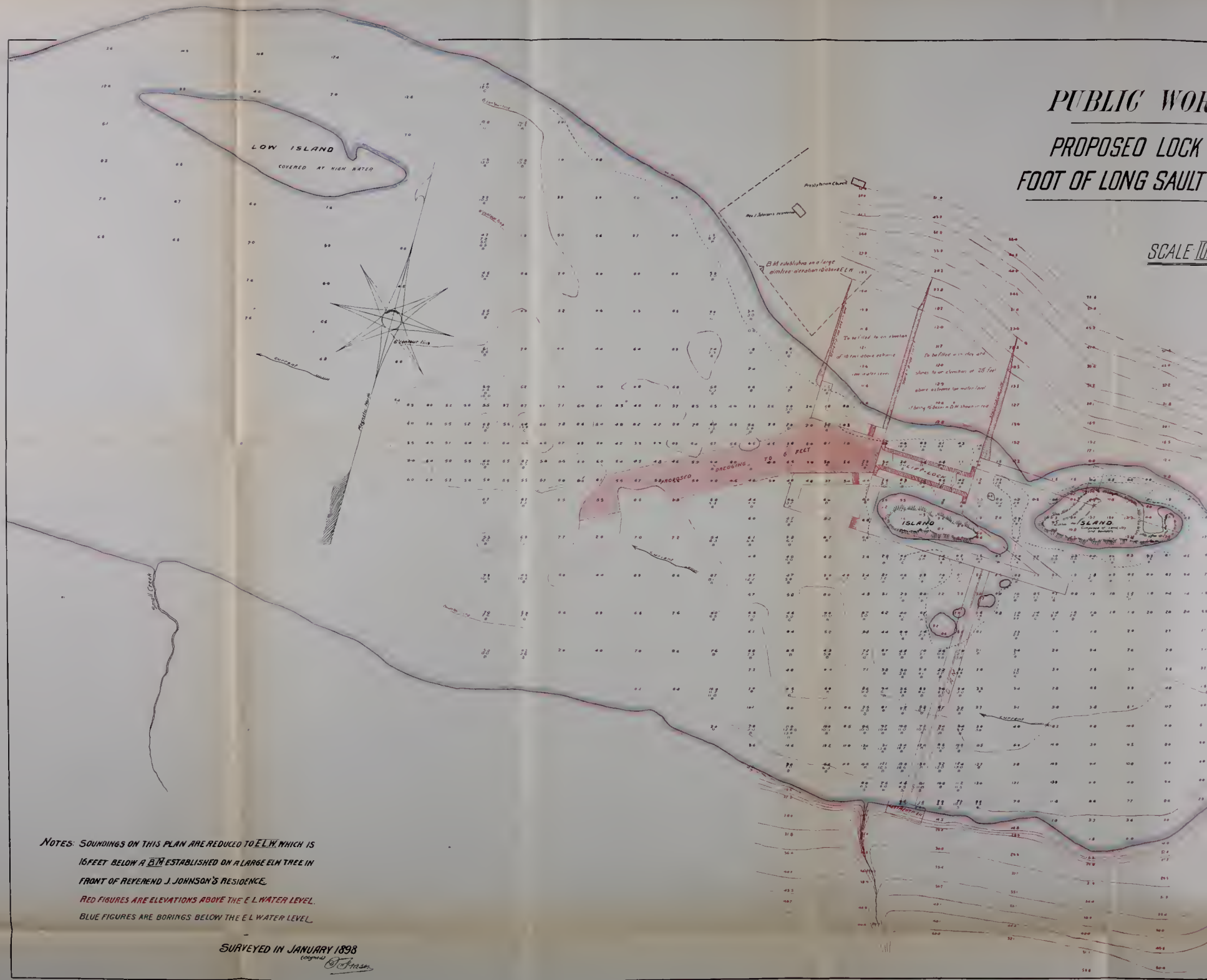
'That the said proposals, apart altogether from any engineering problems involved or any question of water levels or depths, are prejudicial to navigation interests.

'That no additional or improved locks at this point, of the character so far suggested, can compensate for the disadvantages, temporary as well as permanent entailed in the scheme, to justify in the slighest the proposed interference with the free channels.

'That the Dominion Marine Association be placed on record as protesting absolutely against the proposed works.'

The Richelieu and Ontario Navigation Company and the Calvin Company, Limited, have also filed objections.

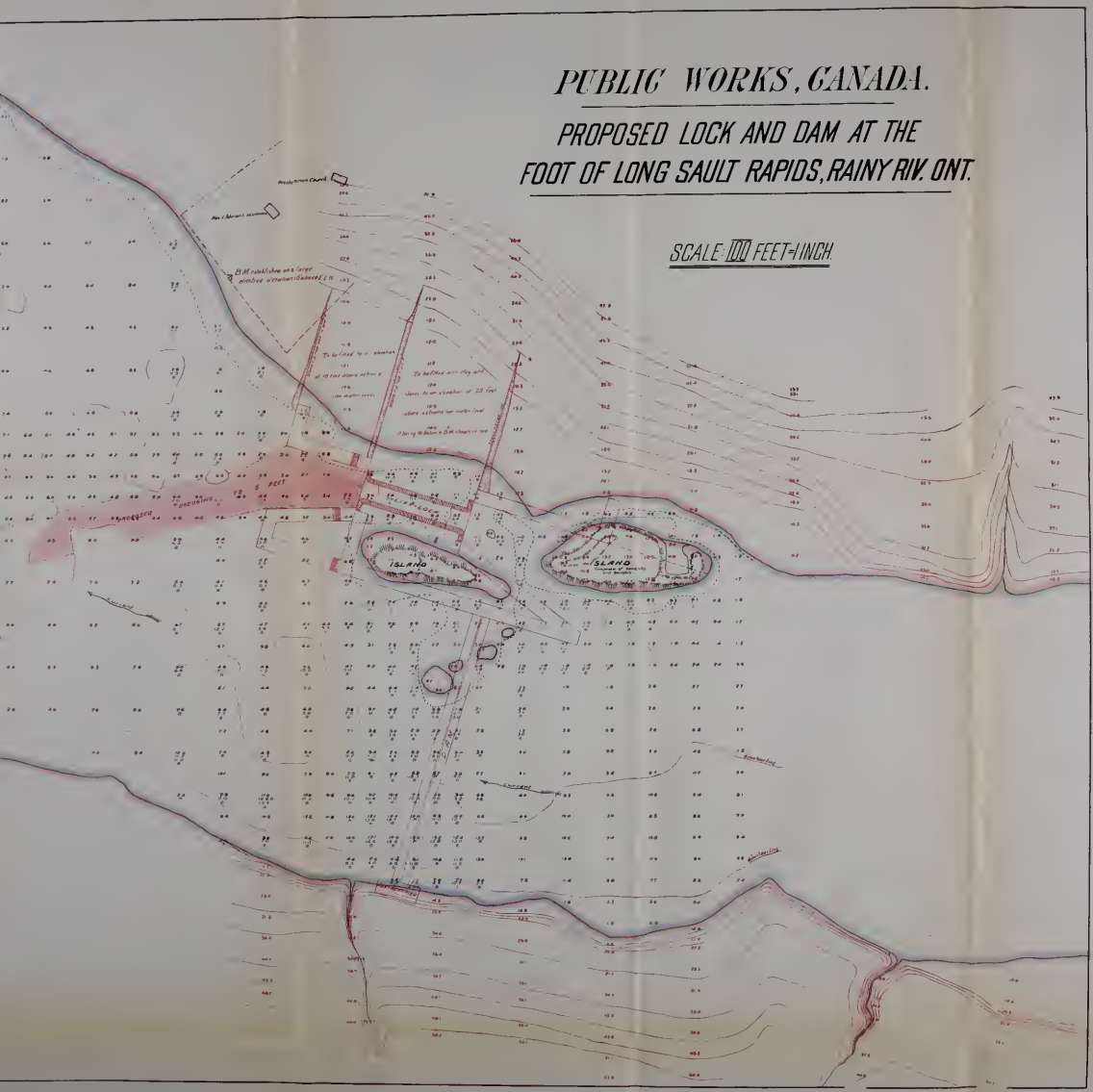
On the other hand, we have a demand for the use of this water, for the development of electrical energy, which undoubtedly would be a material benefit both to Canadian and United States interests within a reasonable distance of the proposed works. The real issue is: What would be the effect upon navigation interests? It is conceded that these interests are paramount and must not be injuriously affected. Your commissioners are not in possession of sufficient data to form an opinion on the matter, but are making every effort to obtain the same.


PUBLIC WOR
PROPOSED LOCK
FOOT OF LONG SAULT
SCALE
LOW ISLAND
COVERED AT HIGH WATER
Presbyterian Church
Mrs J. Johnson's residence
B.M. established on a large elm tree 16 feet E.L.W.
To be filled in on slopes of 1 to 1 above extreme low water level
To be filled in on this slope to an elevation of 25 feet above extreme low water level
(Being 16 feet B.M. shown in red)
6 FEET
DREDGING
PROPOSED
SHERRARD
ISLAND
ISLAND
Current
Small Creek
Magnetic North
Contour line
NOTES: SOUNDINGS ON THIS PLAN ARE REDUCED TO E.L.W. WHICH IS
16 FEET BELOW A B.M. ESTABLISHED ON A LARGE ELM TREE IN
FRONT OF REVEREND J. JOHNSON'S RESIDENCE.
RED FIGURES ARE ELEVATIONS ABOVE THE E.L. WATER LEVEL.
BLUE FIGURES ARE BORINGS BELOW THE E.L. WATER LEVEL.
SURVEYED IN JANUARY 1898
(signed) T. Fraser

PUBLIC WORKS, CANADA.

PROPOSED LOCK AND DAM AT THE FOOT OF LONG SAULT RAPIDS, RAINY RIV. ONT.

SCALE: 100 FEET = 1 INCH.



Independent expert advice is being sought. The matter will not be dealt with hastily, but is of such vital importance that your commission would be glad of any information that would assist them in arriving at a wise and proper conclusion.

RAINY RIVER IMPROVEMENT.

By Order in Council dated May 6, 1907, reference was made to our commission of this matter, as follows:—

'On a memorandum dated May 2, 1907, from the Acting Minister of Public Works, stating that, in order to improve the navigation of Rainy river, a navigable stream forming part of the boundary between the Province of Ontario and the State of Minnesota, in which the existence of two rapids renders the navigation difficult and dangerous, the Chief Engineer of the Department of Public Works was requested to cause an examination and report to be made. In this report Mr. J. W. Fraser strongly recommends the construction of a dam at the foot of Long Sault rapids, a section of which will abut on United States territory. This dam, built of timber, would raise the water to a sufficient height to obliterate both the Manitou and Long Sault rapids, which interrupt the navigation of the river about the middle of its course.

'The Minister further states that Parliament at its last session provided an amount of $50,000 towards the commencement of this work.

'The Minister, in view of Rainy river being an international stream, recommends that before any action is taken the question of its improvement be submitted to the International Commission for consideration and report.

'The Committee submit the same for approval.

The United States section, having doubt as to their jurisdiction, have asked their government for further instructions. In the meantime, as the matter was pressing, and with their concurrence, our section have reported as follows:—

'1. Rainy river is an international waterway connecting the lake of the same name with the Lake of the Woods, and is 85 miles in length. The stream between the Lake of the Woods and the foot of the Long Sault rapids, a distance of 40 miles, is, or can readily be made, navigable for boats of 6 to 7 feet draught for the full season of navigation, being controlled by a dam at Kenora; but its further use, during the low-water period, is prevented by the Long Sault and Manitou rapids, which lie approximately mid-way between the Lake of the Woods and Fort Frances; the Long Sault are 1½ miles in length and have a total rise (at extreme low water) of 7½ feet; the Manitou are located 6½ miles farther up, and are about 200 feet in length, having a total rise of 2·0 feet. Between these two obstructions there is a rise of 1·9 feet, and between the head of the Manitou and the foot of the Fort Frances rapids, a distance of 36 miles, the rise is 14·4 feet; making a total ascent in the 44·5 miles of river to be improved of 25·5 feet at extreme low water. The banks of the river along the reach under consideration are generally steep and from 28 to 40 feet high, so that the flood waters over run but very few acres.

'2. The proposition contemplates the erection of a dam at the foot of the Long Sault rapids capable of raising the water 11 feet above extreme low water and flooded out both rapids. In connection with this dam is to be a lock (approximately 55 by 200 feet in size) for the passage of vessels. Because this dam must cross into United States territory, the International Waterways Commission have been asked to consider and report upon the improvement.

'3. We have examined the records of the Department of Public Works of Canada pertaining to this project, and find there maps and other data, obtained from actual surveys, which verify the figures and description given above.

'4. The effect of backwater during the low-water stage cannot be accurately determined from the meagre data at hand, but an approximation would seem to limit its effect to a point 5 miles above Manitou rapids. The effect of the backwater at high water is hardly determinable in the absence of gauge records at Fort Frances during floods, but it is not believed that it can be seriously detrimental. The new low-water level in the reach between Manitou and Long Sault rapids will be, at most, four feet higher than at present and will, therefore, cause no flooding of the shores.

'5. Whilst at present, during the freshets, the water rises 16 feet above extreme low water, it appears certain that, under new conditions with proper controlling dams both above Fort Frances and at the new dam, and the increased cross-sections in the vicinity of the two lower rapids, the new flood level need be very little above the new low water. Such a control will improve navigation and maintain nearly constant the water-power head at Fort Frances and Couchiching. It is taken for granted that the design of the dam and lock will be such as to permit the passage of vessels at all times, whether the river is in flood or not; otherwise the highest interests of navigation would not be subserved.

'6. After considering the project, no objection can be seen to the proposed improvement; on the contrary, it has much to commend it.

'7. In this matter the members of the United States Section of the International Waterways Commission claim to have no jurisdiction, and this section therefore respectfully recommends that the Canadian government request the government of the United States to grant them permission to carry out the proposed works.'

REGULATION OF LAKE ERIE.

Ever since the formation of the commission we have been considering, from time to time, the question of erecting a dam or dams in the Niagara river, with a view to maintaining the level of Lake Erie. In the Act of Congress creating the United States section of this commission this reference is made to the matter:—

'The said commissioners shall report upon the advisability of locating a dam at the outlet of Lake Erie, with a view to determining whether such dam will benefit navigation, and if such a structure be deemed advisable, shall make recommendations to their respective governments looking to an agreement or treaty which shall provide for the construction of the same, and they shall make an estimate of the probable cost thereof.'

A large amount of labour has been expended upon this investigation of the problem. Several schemes have been proposed. The commission have agreed that no works would be authorized, the effect of which would be to lower the levels in Lake Ontario or the St. Lawrence river. Of course, if some scheme can be devised which will improve navigation in Lake Erie without injury to other interests, it should be supported, but the whole matter will receive most careful consideration before any recommendation is made.

NIAGARA FALLS POWER DEVELOPMENT.

Owing to the very great public interest in this subject, it is perhaps desirable that we should repeat some of the matter contained in our previous reports.

Soon after the organization of our commission, we found the members of the United States section anxious to deal with the subject of the preservation of Niagara falls. Action was, no doubt, forced upon them by public opinion generally, as well as by the personal views of President Roosevelt, as expressed in his message to Congress. The American Civic Association, having a very

large membership scattered throughout the Union, was pledged to work together in order to preserve the scenic effect of the falls, 'in all their beauty and majesty'. While Canadian feeling had not been aroused upon the subject, it was certainly not desirable that we should put ourselves (if it could possibly be avoided) on record in opposition to this movement.

Up to the time that the agitation took voice and was emphasized by the President's message, corporation after corporation had obtained charters to divert water from the Niagara river, above the falls. The result, if all had gone into operation, undoubtedly would have been to completely destroy the scenic effect. Fortunately only two companies in New York state and three on our side of the river had actually constructed works. In New York state the Niagara Falls Hydraulic and Manufacturing Company and the Niagara Falls Power Company had works in course of construction requiring about 18,100 cubic feet per second. On the Canadian side the Queen Victoria Niagara Falls Park had entered into leases and agreements, ratified by the Ontario Legislature, with three companies:—

1. The Canadian Niagara Falls Power Company, 110,000 horse-power, requiring 8,600 cubic feet per second.
2. Ontario Power Company, 180,000 horse-power, requiring 11,700 cubic feet per second.
3. Electrical Development Company, 125,000 horse-power, requiring 10,750 cubic feet per second.

The joint commission had agreed, as one of the principles which should govern the use of boundary waters, that, where there could be temporary diversions without injury to the interests of navigation for the purpose of developing power, they should be allowed, so that each country, so far as was practical, would receive an equal benefit. Neither country has any right of property, but only a right of user, in these flowing waters. The paramount right to use the great water system, starting with Lake Superior and finding its way by the St. Lawrence to the sea, is for navigation purposes, but as temporary diversions are possible at Sault Ste. Marie, on the Niagara river, on the St. Lawrence river and elsewhere without injury to the interests of navigation, it is, of course, desirable that they should be permitted, and we think it is manifest that each country is entitled to an equal benefit therefrom.

From Niagara river, above the falls, for some distance, water could be diverted, on either side without any injury to the interests of navigation; in fact, such interests would not have been affected if all the water had been so removed and returned to the river again farther down, and before reaching the point where navigation became possible. The only objection, therefore, to such temporary diversion of water is the effect upon the scenic beauty of the falls. The diversion, on our side, being almost entirely below the crest of the rapids, has no appreciable effect upon the flow over the American falls, and as the flow of water over the Canadian or Horseshoe falls is seven times greater than that over the American, it was felt that we could be permitted to take a larger quantity than it was possible to take upon the United States side without injury. The citizens of the United States had also diverted 10,000 cubic feet of water per second at Chicago which in its natural course would have flown over Niagara, and this was taken into consideration.

It is manifest that some arrangement must be arrived at between the two countries with regard to the regulation and use of boundary waters, otherwise chaos will prevail. At Niagara, on each side of the river, charters had been granted under which water in unlimited quantities could have been taken at points farther up the river. On our side it was sought to use the Chippewa river to drain the waters of Niagara into a new outlet—a canal to be built to a point near St. David's. Another Canadian charter sought to divert the waters

of Lake Erie to a point near Jordan. On the New York side there was no limitation to the water which could be taken under several charters.

All these proposed developments would affect, more or less seriously, the level of Lake Erie and all are objectionable on that account and wholly opposed to the principle adopted by the commission. The direct diversion from Lake Erie to the Jordan river is especially objectionable. The diversion of 10,000 cubic feet per second would have a more serious effect upon the level of Lake Erie than the diversion from Lake Michigan, at Chicago, of a like amount. It would mean the reduction of the lake level by more than six inches.

It is needless to say that navigation interests of both countries would refuse to submit to such an injustice. Chicago sought to justify itself by the necessity of preserving the public health, and evidenced their good faith by the expenditure of about fifty million dollars upon the project. Here navigation interests would be very seriously affected merely for the purpose of a profit by the production of power.

The joint commission succeeded in agreeing upon the following conclusions:—

The commission has made a thorough investigation of the conditions existing at Niagara falls, and the two sections have presented reports to their respective governments setting forth these conditions to which attention is invited. The following views and recommendations are based upon a careful study of the facts and conditions set forth in these reports :—

1. In the opinion of the commission, it would be a sacrilege to destroy the scenic effect of Niagara falls.

2. While the Commission are not fully agreed as to the effect of diversions of water from Niagara falls, all are of the opinion that more than 36,000 cubic feet per second on the Canadian side of the Niagara river or on the Niagara peninsula, and 18,500 cubic feet per second on the United States side of the Niagara river, including diversions for power purposes on the Erie canal, cannot be diverted without injury to Niagara falls as a whole.

3. The commission, therefore, recommend that such diversions, exclusive of water required for domestic uses or the service of locks in navigation canals, be limited on the Canadian side to 36,000 cubic feet per second, and on the United States side to 18,500 cubic feet per second (and in addition thereto a diversion for sanitary purposes not to exceed 10,000 cubic feet per second, be authorized for the Chicago drainage canal), and that a treaty or legislation be had limiting these diversions to the quantities mentioned.

4. The effect of the diversion of water by the Chicago drainage canal upon the general navigation interests of the Great Lakes system has been considered in a separate report.

5. The Canadian section, while assenting to the above conclusions, did so upon the understanding that in connection therewith should be expressed their view that any treaty or arrangement as to the preservation of Niagara falls should be limited to the term of twenty-one years, and should establish the principles applicable to all diversions or uses of waters adjacent to the international boundary, and of all streams which flow across the boundary.

When the Park Commissioners with the full authority of the legislature entered into their agreements with three companies, no one anticipated or, if they did anticipate, then foretold the consequences. The Park Commissioners were getting large rentals, and the general opinion undoubtedly was that it was desirable to have these industries established. It is only fair to say that their works are magnificent results of the highest engineering skill, and that all the companies have joined with the commissioners in the endeavour to preserve, as far as possible, the natural beauty of the park.

It, perhaps, would have been wise if development had been limited to the generation of electricity for distribution in Canada. In that case we would

most likely have had only one corporation up to this time, and, moreover, would have had the Canadian market fully supplied. It was undoubtedly the intention, when these leases were made, that each of the companies would find a market in New York state for part of their power, and also that each of them would supply power in Canada. It is also evident from the agreements that it was contemplated that the companies would themselves build transmission lines and deliver power both in the State of New York and the Province of Ontario. The provision in each and all of the agreements was as follows:—

'The syndicate, whenever required, shall from the electricity or pneumatic power generated under this agreement, supply the same in Canada to the extent of any quantity not less than one-half the quantity generated, at prices not to exceed the prices charged to cities, towns and consumers in the United States, at similar distances from the Falls of Niagara, for equal amounts of power and for similar uses, and shall, whenever required by the Lieutenant Governor in Council, make a return of prices charged for such electricity or power, verified under oath by any chief officer of the syndicate, and if any question in dispute arises, involving the non-supply or prices of electricity or power for consumption in Canada, the High Court of Justice of Ontario shall have jurisdiction to hear and determine the same and enforce the facilities to be given or the prices to be charged.'

The price, it will be seen, was to be fixed at the place of delivery, which, of course, implied that the companies were to build transmission lines and deliver. These corporations did what was to be expected, with so little control over their operations. By dividing the territory to be supplied, they avoided competition with each other, and two of them, by the formation of allied companies in New York state to distribute the power there sought to nullify the effect of the only provision designed to protect the Canadian consumer.

The Canadian Niagara Power Company arranged to deliver its power to an allied company, the Niagara Falls Power Company, which built a transmission line to Buffalo and distributes the power of both companies. This company has taken to itself the market of Niagara Falls, in New York State, and Buffalo.

The Ontario Power Company formed a subsidiary company in New York state, known as the Niagara, Lockport and Ontario Company, and the latter company has built transmission lines in that state 200 miles in length with branches, at a cost of upwards of four million dollars. This corporation supplies Rochester, Syracuse, Utica and manufacturing towns along and within reach of their transmission lines, all in New York state. It actually entered into a contract (subject to its agreement with the power company) to supply all of its 180,000 horse-power to its subsidiary company and has not, until recently, made any serious effort to supply the Ontario market.

The Electrical Development Company has built a transmission line to Toronto, but it also seeks an outlet in New York state for its surplus power.

The plain meaning of the agreements with each company was that it was to be permitted to transmit part of its power to New York state, but was to reserve half of its supply for use in Canada, and was to deliver the same at prices similar to those charged in New York state. By transmitting in New York state, only through the medium of their allied companies, they made it impossible to require them to deliver in Ontario, at equal distances, at equal prices. As they delivered to their allied companies at Niagara Falls, they were in a position to say to the Canadian consumer: 'If you require power, you must build your own transmission lines and come to Niagara falls for it.'

The situation is full of difficulties. The companies have spent over twenty million dollars on their works and must find markets. It was evidently the original intention of both the Ontario Power Company and the Canadian Niagara Company to practically ignore the Canadian market. Unless some action

could be taken which would control the export, it seemed to the members of your commission inevitable that all three companies would seek the more accessible and profitable market in New York state to the neglect of our own, and we urged in our former report that your government should protect the Canadian public by exercising your right to control and regulate the export of electrical energy.

By chapter 16, 6-7 Edward VII., statutes of Canada, and known as 'The Electricity and Fluid Exportation Act,' such control was taken. Sections 4 and 5 provide as follows:—

'4. Subject to any regulations of the Governor in Council in that behalf the Governor in Council may grant licenses upon such conditions as he thinks proper for the exportation of power or fluid where a right to export exists by lawful authority; and such license shall be revocable upon such notice to the licensee as the Governor in Council deems reasonable in each case.

'5. Any such license may provide that the quantity of power or fluid to be exported shall be limited to the surplus, after the licensee has supplied for distribution to customers for use in Canada power or fluid to the extent defined by such license, at prices and in accordance with conditions, rules and regulations prescribed by the Governor in Council.

'2. Every such license shall be revocable at will, by the Governor in Council if the licensee refuses or neglects to comply with any of the conditions imposed with regard to the supply and distribution of power or fluid in Canada.'

It did seem to us that it was a fair solution of the problem to say to each of the companies, 'You must carry out the terms of your agreement in its spirit by taking care of the Canadian market at reasonable distances from Niagara alls and at reasonable prices, at all times, to the extent of at least one-half of he power generated. If you carry out your obligation in that regard, you will be allowed to export your surplus, but not otherwise.'

The control over one-half of the production would undoubtedly supply all the demands of our Canadian market for many years to come, and it would not be any great hardship upon the companies to compel them to jointly or severally build the necessary transmission lines to care for the same. While we think it should be a condition of the charters of all companies hereafter incorporated in Canada that the power generated should be distributed wholly in this country, that principle cannot with fairness be applied to these corporations at Niagara Falls.

It is manifest that when they were permitted to develop 400,000 horse-power, a market must be found for much the greater portion, for the present at least, in New York state.

If the companies had themselves delivered power in New York state, the prices there at equal distance in equal quantities was to be the test as to what price was to be charged the Canadian consumer. As they have made that test impossible by delivering all their power at Niagara falls, the price which they should be allowed to charge in Canada must be fixed in some other way. It was undoubtedly intended to be limited. The public have no right to expect power cheaper than it can be delivered after allowing an adequate return to the companies upon their investment. The rate to be charged, therefore, should be under some form of government control and regulation.

The companies should be treated alike. Each of them entered into the same obligation with regard to our market, and each should be compelled to carry out the terms of its agreement. If that be done, the regulation of the exports will be simple, the surplus only be exported by each, after each had done its share towards satisfying this Canadian demand. Under this plan the public will receive just what it is entitled to, the supply of power at reasonable prices, and no injustice will be done to any of the companies. It would be monstrous if all but 40,000 or 50,000 horse-power of the total 400,000 develop-

ment should find a market in New York state. The public in Western Ontario are thoroughly aroused against this threatened injustice.

Under the provisions of 'The Electrical Exportation Act', the companies of Niagara falls are compelled to take out temporary licenses under regulations, a copy of which is appended and marked 'D', and so control is kept over their export, and they have notice that they must recognize their obligations to our market.

The Ontario Power Company is now extending its lines to St. Catharines, and, it is understood, both it and the Canadian Niagara are now offering power to the Hydro Commission.

The Legislature of Ontario at its last session passed 'An Act to provide for the Transmission of Electrical Power to Municipalities,' Statutes of Ontario, 1907, page 169. Section 8 provides as follows:—

'The Lieutenant Governor in Council, upon the report of the commission recommending the same, may authorize the commission:

'(*a*) To acquire by purchase, lease or otherwise, or without the consent of the owners thereof or persons interested therein to enter upon, take and use the lands, waters, water privileges, water-powers, works, machinery and plant of any corporation or persons owning, holding under lease or otherwise or developing, operating or using the same for generating or adapted for generating electrical power or energy or for the transmission thereof in Ontario; and to develop and use the same for any of the purposes of this Act.

'(*b*) To construct, maintain and operate and to acquire by purchase, lease or otherwise, or without the consent of the owners thereof or persons interested therein to enter upon, take and use, all erections, machinery, plant, and other works and appliances for the transmission and supply of electrical power or energy, and to conduct, store, transmit and supply electrical power or energy for the purposes of this Act and with lines of wires, poles, conduits, motors or other conductors or devices to receive, conduct, convey, transmit, distribute, supply or furnish such electrical power or energy to or from any corporation or person at any place through, over, under, along or across any lands, public highway, bridge, viaduct, railway, waters or watercourse, and through, over or under the lands of any corporation or person, and to enter upon any lands upon either sides of such lines or conduits and fell or remove any tree or limb thereof, or obstruction, which in the opinion of the commission, it is necessary to fell or remove.

'(*c*) To contract with any corporation or person generating, transmitting or distributing electrical power or energy or proposing so to do, to supply electrical power or energy to the commission; and to require any corporation or person generating, transmitting or distributing electrical power or energy to supply so much thereof as the commission may require.'

It is proposed, under the provisions of this Act, that the commission shall build or acquire transmission lines from Niagara falls for the purpose of supplying power to the various municipalities, capable of being served from that point, and various municipalities interested have, by their votes recently taken, signified their desire to enter into agreements with the commission to that end.

It will be unfortunate if, with the same object in view, the protection of the public interest, the policies adopted at Ottawa and Toronto should work apart. It is not for our commission to say whether private ownership with government control or municipal ownership should prevail with regard to the distribution of power from Niagara falls. We say that it is the duty of the companies to distribute at reasonable distances and at reasonable prices, and that they should be compelled to do so in equal proportions, so that the control over the export of each may be maintained by our government. If however, the municipalities of Western Ontario elect to assume the burden of distributing, in the

hope of thereby securing cheaper power, it does seem to us to be a most desirable essential in the working out of that plan that they should take over all the distribution and should acquire their power at Niagara falls, not from one company, but proportionately from each, so that the control over the export of each can be maintained.

It is manifest that if the Hydro Commission take all their power from one company, the Ontario Power Company, as proposed, they will come into active competition with the Electrical Development Company, the only company which has made a real attempt to supply our market, and they will, at the same time, relieve the other two companies from an obligation towards that market. By assuming the responsibility of the distribution, they practically do away with the provision in the agreement by which the companies are required themselves to distribute in Canada.

Duplicate lines would be wasteful and undesirable. If the Hydro Commission distribute, therefore the companies cannot be expected to do so in competition. It follows also that if the Hydro Commission take all their power at Niagara falls from one company, the others must be permitted to export all, or nearly all, and the inevitable result must be to make your Act with regard to the exportation of power unworkable.

If a policy be adopted which enforces the obligation, at all times, of each of the companies to our market, each of the companies will make their American contracts subject to conditions which will enable them to supply, from time to time, the increasing Canadian demand. If, however, any of them are excused from its present obligation to our market, it will be much more difficult later on to enforce its obligation to it. Contracts will have been made in New York state, and vested interest created which will complicate the situation.

Your commission respectfully submit that each of the companies should be compelled to supply the Canadian demand proportionately, and only be allowed to export its surplus. Their obligation is to distribute power at reasonable distances and at reasonable prices. If they are relieved of the obligation to so distribute, they should not be relieved of the obligation to proportionately supply the power at Niagara falls and at fair prices.

If the principle of proportionate supply to the Canadian market be maintained, your government could control the export, and so insure at all times an ample supply for our use. This policy would be quite consistent with the terms of the agreements, not to do injustice to any of the companies, and yet fully conserve the public interest.

If we should ever require more than 200,000 horse-power (half of the production), we can safely leave, until then, the adjustment of that difficulty. In the meantime an additional supply may be made available by the use of the water below the falls.

All of which is respectfully submitted.

GEO. C. GIBBONS,
Chairman, Canadian Section.

LOUIS COSTE,
Member, Canadian Section.

WM. J. STEWART
Member, Canadian Section.

THOMAS COTE,
Secretary, Canadian Section.

APPENDIX 'A.'

QUEEN'S HOTEL,

TORONTO, Thursday, Oct. 24, 1907.

Commission being in Session.

ST. LAWRENCE POWER COMPANY.

LONG SAULT DEVELOPMENT CO.

The following gentlemen composed the deputation: Geo. G. Foster, Esq., K.C., President St. Lawrence Power Co.; Leighton C. McCarthy, Solicitor St. Lawrence Power Co.; Arthur V. Davis, President Long Sault Development Co. (U. S.); John R. Freeman, J. W. Rickey, Engineers.

Before the deputation were heard, Secretary Cote, of the Canadian section read the following letter from the Prime Minister, Sir Wilfrid Laurier:

PRIME MINISTER'S OFFICE, CANADA.

OTTAWA, October 12, 1907.

MY DEAR GIBBONS,—I understand that about the 23rd of this month there is likely to come before you and the other members of the Waterways Commission a question relating to the possible development of power at or near Mille Roches, or Cornwall, to be developed in conjunction by a Canadian and an American company. Application has been made to the Minister of Railways and Canals by the Canadian Company, the St. Lawrence Power Company, and the Minister has instructed the Chief Engineer to examine into and report to us upon that application, which examination will take place at the earliest possible date.

It seems to me that it would be inadvisable for your commission to deal with the matter until the Department of Railways and Canals is fully seized of it. I will be obliged to you if you will bear this in mind in your proceedings.

Yours very sincerely,

(Signed) WILFRID LAURIER.

GEO. C. GIBBONS, Esq.
London, Ont.

The commission, in view of the fact that the interested companies and corporations had sent representatives to be heard at this meeting, decided to to hear the deputation before discussing the matter.

Mr. MCCARTHY: Your commission, learning that certain works were in contemplation, communicated with the Long Sault Development Co. and desired to hear from them. You called them, I think, in April last in Buffalo. At that time they were not in a position to answer the request which you made, and asked for a postponement till the present time. As I understand it now, we are here in answer to that request from your commission, prepared to answer anything that your commission may desire to know that is within our power. I may perhaps say, in elucidation of that situation, that the St. Lawrence Power Co., being a Canadian corporation now doing business with a plant in operation on the north shore of the St. Lawrence, are also here represented for the purpose

of hearing what is said. Being in the position of having supplied all the power they could manufacture, and being desirous of getting more power in order that they may answer the demand in that locality, they are anxious that this scheme should be approved of and be endorsed by this commission. Without such development as will be outlined to you by people much more competent than I am, the limitation of the St. Lawrence Power Co. is very small in horse-power. With co-operation, and with endorsation of the scheme which will be outlined to you, the development of power there will be very much enlarged, and that locality from Cornwall to Brockville, and perhaps even further, can be supplied by this company with power, which is a very much needed commodity along that shore and in that district, in order that manufactures may prevail. I don't know that I should say anything more in opening the matter. I think it would be much better that the scheme should be outlined by you in its technical form—seeing the difficulties in the way, and presenting the advantages to be obtained. The one dominating feature in my mind, over and above the question of power, which is, perhaps, the pre-eminent feature, is that the scheme which is presented to you will improve so greatly and so vastly the navigation at that point, which has always been a source of difficulty, and with one lock will make possible the absolutely free navigation of those rapids. At the present time, on the Canadian side you have to go through some six locks. I am not going to say any more, because I think the technical details can be so much better presented by others who will follow me. I will first ask you to hear formally Mr. Foster, K.C., President of the St. Lawrence Power Company.

Mr. Foster: In addition to the remarks of our attorney, Mr. McCarthy, I have little to say except this—that the syndicate whom I represent, when they purchased the St. Lawrence Power Co. were under the impression that they were going to be able to develop from the point known as Hoople's creek, a very considerable addition to the power which we bought. We are only able now to develop about 1,250 horse-power. The limit has practically been reached with the expenditures now made. We are sold out now. To-day we are having demands made at East Lanark, at Cornwall, at Mille Roches, and other places for power. In looking about we made a thorough and exhaustive examination of the property at Hoople's, with the result that it is impossible commercially and financially to develop that power, and we turn to you now with this proposition as the only means to-day of practically extending our power. We think that the expenditure which could possibly be made by enlargement of the canal, and which possibly may be referred to by some, is practically financially impossible,—it cannot be done with an expenditure which is going to make it commercially successful. But the expenditure which will be represented by the plans we will put before you, and which our engineers have prepared the past summer, will present a scheme which will result in great advantage not only to our company, but to the people in that section of the province I may say that at this moment, taking into account the money which we spent in the purchase of the property, we have, in the purchase of the stock, and in the obligations which we have incurred, an investment at that point to-day of a million dollars. That includes the purchase of land and certain rights that are necessary in order to carry out the proposal which we will explain to you.

Chairman: I may say that some of the strongest objections brought before the commission came from your city—the Montreal Board of Trade and the Canadian Marine Association. I merely tell you that now so that you will bear in mind and perhaps have an opportunity of meeting it there.

Mr. Foster: I have no doubt we will be able to do that, but until we know what objections are made we are not able to discuss it thoroughly. It may save trouble for all of us if I say that we believe we can satisfy this commission and

satisfy the public of Montreal, and everybody else interested in the St. Lawrence route, that we can improve the condition that exists there to-day; and if we cannot satisfy them on that point, I quite realize the very great importance of the objection that has been raised. But I say that we can. We believe we can do away with that objection.

CHAIRMAN: We have formed no opinion. I only suggest it.

Mr. FOSTER: I make that suggestion because I want to be plain—that we have anticipated, have looked into, and had our engineers examine that very situation.

Mr. COSTE: Is the plan submitted as a whole, or are there two schemes, or is it a joint scheme?

Mr. FOSTER: What we propose to put before you from our side is a co-operative scheme, but I propose to put before you on our own plan the work that we have done, and let the American side put their's before you.

CHAIRMAN: Are they two distinct corporations?

Mr. FOSTER: Yes.

CHAIRMAN: In operation as well?

Mr. FOSTER: No, I believe the American one is not. Ours is a Canadian company, with a Canadian charter.

Mr. RICKEY: (Producing plan on scale of 500 feet to the inch)*—In order to develop power here at all it is absolutely essential that co-operation exist between the Canadian side and the American side. I have shown on this map a plan of what the Canadian side proposes to do. The object in that is to show that it is absolutely impossible to develop power without the co-operation of American interests. Then I have a map which shows the combined project. At the present time there is a comparatively small amount of water coming through this Sault channel. The main body of water comes down through crossing the international boundary line and going entirely into American territory, and then coming back. You will notice that the international boundary line bisects the channel at this point (showing on map). The average flow of the entire river since 1860 is 250,000 cubic feet per second. I gauged this channel, called Little River, and found an average of 10,500 feet, which is only four per cent of the water in the river coming through the international channel. All the rest, 96 per cent, barring such as is used for this little plant here and for lockage purposes, leaves the international waters here, goes entirely into American waters, then comes back into international waters down here (pointing east). As Mr. Foster indicated, an investigation has been made showing the physical possibilities of development here (west)—this bank being very steep—the rapids are right under here; there is a narrow dyke separating the rapids from the canal on the south side, on the north side of the canal the bank is very steep and very high, so that in order to increase the power down at the present plant at this point (showing) it would be necessary to construct a canal 12,500 feet long, with an excavation running from 40 to 60 feet deep. So that from a commercial standpoint it is not feasible. It is physically possible to do it, but it would not pay a return on the investment. The plan is to construct a dyke down at this point (indicating power plant) so as to raise the water five feet above its present level, and a dam just above lock 20 as indicated on the map, then a power house being constructed here, the same would thence run westerly, then having a V-shape and run southeasterly to the international boundary line. Assuming that to be constructed, the water would still flow

*This plan was not left with the commissioners as it was not final. It was used by Mr. Rickey, in the course of his remarks for the purpose of demonstrating and outlining.

in its natural channel, and the 5,000 feet of water per second that is now flowing in what is commonly known as Little river (which is the channel between Barnhart and Sheek Island) would then flow through the gap between the dam shown on the plan and the foot of Barnhart island.

CHAIRMAN: I thought it was 10,000 feet per second, not 5,000?

Mr. RICKEY: There is 10,500 altogether, so approximately 5,000 are in Canadian territory and 5,000 are in American territory. I say 10,000 feet would go through this narrow gap and no increase of head would result, consequently no power could be developed without co-operation of American interests. This map shows the completed scheme, showing the dam constructed from the foot of Long Sault island to the head of Barnhart island. At the lower end of Barnhart island is the V shaped dam, only it is extended to meet Barnhart island. As soon as these dams are constructed, then the water instead of passing through the channel on the south side of Barnhart island is deflected north; and we will enlarge the channel of Little river which lies between Barnhart and Sheek islands, thus deflecting the water into the international channel. We propose to get water on the north side of Sheek island. Assuming that construction made, what will be the result? We have the water in what we might term our mill-pond, say four or five feet higher that the present water level in the canal at the north of Sheek island. That will necessitate the construction of a lock here—about 2,500 feet or half a mile above lock 20—that lock to be constructed at our expense. That lock, incidentally will replace lock 21, which is farther west. There are six locks in the Cornwall Canal system. The boats having passed through lock 20, assuming they are passing up-stream, will then pass through the new lock I refer to, and will then go up-stream with full headway. This channel is approximately 800 feet wide. After passing through lock 20 at present, the boats go through a narrow tortuous channel through the swing bridge opening, and then by a circuitous route through the Cornwall channel; then at the upper end of Sheek island they enter the upper end of the Cornwall canal, and then pass through what is known as lock 21. This other way is almost a straight line right up the river. In these narrow canals the boats are legally allowed four miles an hour, because if they go faster, that is the large boats, the erosion on the banks is very objectionable. Here they can go up under full speed. The proposition further embraces the construction of a power-house in the South Sault channel at the foot of Long Sault island, and the construction of a lock on the American side, which will enable boats to make the entire descent that is now accomplished by six locks, in one lockage, so that boats coming down the river, can enter this South Sault channel, which will be a very wide and perfectly navigable, passing through one lock, and then down the river under full headway. The estimated saving in time is approximately four hours on the rough trip of the boats. Likewise, going up stream, they can pass through the same lock. If, on the contrary, the shipping interests desire to use Canadian locks, the system of lockages below lock 20, and including lock 20, is not interfered with in the least. They come down, just as they do, as far as lock 21; then, instead of entering a narrow canal there (pointing west) they continue down the main channel of the river, where no boats go now with the exception of the Richelieu and Ontario Company's single line of passenger boats, and that only for a very few months in the summer season. Then coming down this 800 foot channel they will pass through the new lock which is above lock 20, then they will go through the present canal system.

Mr. STEWART: Does that do away with lock 21?

Mr. RICKEY: Lock 21 would be replaced by the new lock down here. Now on the contrary, assuming that the shipper did not wish to even go into

the international waters between Barnhart and Sheek islands he could then come down the river, past the present lock 21, go through the enlarged channel between the west end of Sheek island and the mainland, and then come through this enlarged and deepened channel. We propose to dredge that out and widen it and deepen it—and go down and pass through the present canal system. So that there are three choices of routes; one following the same line up as far as the west end of Sheek island, thence entering again the main channel of the river; another, allowing the passage between Sheek and Barnhart islands under full steam; and the other coming up on the south side of Barnhart island and doing away with five lockages. Now, we have made observations as to the length of time required for boats to traverse those locks. The shortest I find was three hours and fifteen minutes, and the longest six hours and forty-five minutes. The latter was a tug with barges in tow. So that a great deal of time will be saved by that, on account of the reduction in time due to the manœuvring of the lock-gates. The traffic will all pass through the one lock.

CHAIRMAN: How will the depth of water be affected here? (Indicating east.)

Mr. RICKEY: The depth of water will be diminished a few feet. At present, the depth there is anywhere from forty to sixty feet, according to the United States Government charts, and when the water is diverted through Little river, down to the lower end of Barnhart island, the depth in the present channel will be decreased approximately four feet, which is negligible in view of the great depth there is there now.

Mr. STEWART: There is a pretty strong current from the foot of Long Sault.

Mr. RICKEY: There is so strong a current that, under the present regime, no boats can come through up that stream at all. There is not a boat—not even the powerful motor boats, which are pleasure boats—can go up this stream, (pointing) or can go up past Long Sault island; and the only boats that come down the channel are the Richelieu boats, light rafts that come down the Long Sault channel, and a few pleasure boats. No ship comes down this channel at all. We have a record of all boats that came down this channel through the last two years.

Mr. COSTE: It would be a submerged dam, I presume? (pointing).

Mr. RICKEY: That is an overflow dam. At present there are only 10,000 feet per second going through there.

It will be increased many many fold, probably anywhere from six to ten fold.

Mr. COSTE: This overflow won't interfere with navigation?

Mr. RICKEY: There is no navigation at the present time at all.

Mr. COSTE: You suggest that as a possible route? (pointing).

Mr. RICKEY: This is about 1,200 feet from the dam. This map represents a stretch over five miles long.

Mr. COSTE: How far is it from this lock to the end of the canal?

Mr. RICKEY: Roughly, five miles.

Mr. COSTE: So the amount of canal which is obviated is five miles.?

Mr. RICKEY: Yes.

Mr. COSTE: There would be no difficulty in navigation above the dam there?

Mr. RICKEY: Not the slightest. The water is already deep there now, and we raise it up forty feet higher. The water there will be forty to fifty feet deep.

Mr. STEWART: How much water will be over the crest of the Long Sault rapids?

Mr. RICKEY: The same amount of water will flow there as flows there now.

Mr. STEWART: You are going to lift it any higher?

Mr. RICKEY: The level will be raised perhaps twenty feet.

Mr. STEWART: At the head of the Long Sault?

Mr. RICKEY: Approximately ten feet there. There is quite a precipitous descent, and unless the exact point was specified I would have to refer to the levels.

CHAIRMAN: What is the lowest depths of water you get on your level, under this system?

Mr. RICKEY: The lowest depth for navigation?

CHAIRMAN: Yes, at any one point.

Mr. RICKEY: It would be considerably over twenty-one feet. I would say twenty-one feet.

CHAIRMAN: You said ten feet at that point; are there twelve feet now?

Mr. RICKEY: Yes, there must be, because the R. & O. boats go down there, and they draw 12 feet.

Mr. CLINTON: What head will you get down at the lower power-house?

Mr. RICKEY: That has not been decided upon definitely. Forty or fifty feet, depending on the result of future studies.

Mr. CLINTON: You propose to set the water back to head of the Long Sault rapids?

Mr. RICKEY: It will be above that.

Mr. CLINTON: How much farther above?

Mr. RICKEY: It will be sent to the head of Croil Island eight or nine miles above I should say. The banks are very steep up there.

Mr. COSTE: How much power will you develop there through the Canadian power house?

Mr. RICKEY: That is a question. What we have worked on so far is to develop the general scheme, and I have only been retained on this just a few months, and those details we have not gone into. For instance, we have been unable to make borings here, to know what our foundations are. We know there is a suitable foundation at some point, and this represents the general scheme.

Mr. COSTE: What is the capacity of this power-house?

Mr. RICKEY: That is laid out for fifty thousand horse-power.

Mr. COSTE: Requiring how much water?

Mr. RICKEY: I would have to figure that out.

Mr. COSTE: You get thirty-five feet of a head?

Mr. RICKEY: Yes, the head on that plan would be less; it would be thirty-five to forty feet.

CHAIRMAN: What is the total power that can be produred here?

Mr. RICKEY: That depends entirely on the height to which we decide to raise the pond, and the flow of the river. The flow of the river in the winter time is such that the water backs up some fifteen or twenty feet down here. I have a chart showing the result of studies on that, and at such times not only is the head reduced, but the quantity is very much diminished. That is another point that deserves some consideration—that we are going to improve the winter conditions here,—the danger of ice gorges just opposite Cornwall. Building these dams creates a mill-pond up there, and allows it to freeze over, and in that manner we avoid the formation of this frazil ice.

Prof. HASKELL: What is the present fall from here to the foot?

Mr. RICKEY: About eight feet.

Mr. DAVIS: The current now is so serious that it is a danger to the United States navigation.

Mr. RICKEY: If no water went down here, there would still be plenty of water for navigation to go through this lock, because this channel is forty to sixty feet deep.

Prof. HASKELL: It would have to be back water.

Mr. RICKEY: It would be back water, and it would be slack water, which would be a decided benefit to navigation.

Prof. HASKELL: Have you made any figures of what you propose to use?

Mr. RICKEY: No, I have men at the present time gauging, to determine the amount of water in this channel.

Mr. CLINTON: This involves the Massena Water-Power Company's right?

Mr. RICKEY: No, they are upstream.

Mr. CLINTON: They had a dyke, I won't say equivalent to a dam, but extending a long way out to the head of Long Sault Island, out into the channel.

Mr. DAVIS: This matter has been presented so far altogether by the Canadian Company, the St. Lawrence Power Co. I represent the Long Sault Development Co., which is the New York State corporation and which proposes to develop and utilize, with your permission, this power in the American territory. With respect to the rights already granted to the St. Lawrence River Power Co.,—which is the correct title of the Massena Company referred to by Mr. Clinton—in case this goes ahead in this way, that proposition for a dyke and development in that manner will be entirely done away with, because it will bequite unnecessary at that time.

Mr. CLINTON: You will get your head up there?

Mr. DAVIS: Yes, as the result of this.

Prof. HASKELL: Do you then propose to abandon that power?

Mr. DAVIS: Oh, no; that power of course is built and paid for and in operation, but I would suppose that the St. Lawrence Power Co. would probably never go ahead any further, because this is a better power proposition, inasmuch as we utilize the full head of the stream at this point here. (Indicating American power-house). Looking at it from a broad standpoint, I consider it is very much better to utilize all the rivers of our country—the United States—so as to get the maximum head, and not waste the head. In this case we utilize the entire flow of the stream. We are also interested financially in the St. Lawrence River Power Co. at Massena, N. Y.

Prof. HASKELL: It would not have any overflow of land, closing that down.

Mr. Davis: I would not say that we would never do that, of course, but you must bear in mind that the power which is being developed now by the St. Lawrence River Power Co. at a distance of six or seven miles from this site is being utilized locally by the Aluminum Co. of America, and to abandon that site would mean the abandoning of the entire aluminum plant, which has cost several millions of dollars. That is the reason we would have to maintain that, to keep the Aluminum Company's proposition running the same as it is now.

Mr. Stewart: Would you raise anything at the head of the Massena?

Mr. Davis: Yes.

Mr. Clinton: The raising of this dam would not affect our Montreal friends?

Mr. Rickey: Not a drop.

Mr. Davis: I might say further, the question is always asked whether we propose to injure anybody with this back water. The Long Sault Development Co. have purchased all Barnhart island, and all this land beginning along about the power-house and running clear up the stream and to the foot of Long Sault island, so that the back-water which is created by this scheme simply goes on to land which is already purchased by the Long Sault Development Co. The same is true with respect to the St. Lawrence Power Co. on the north shore.

Chairman: I thought the bank was high on the Canadian side?

Mr. Davis: It is. The St. Lawrence Power Co., as I understand it, had to acquire practically very little rights as compared with the purchases of land by the Long Sault Development Co. which have been very extensive—numbers of thousands of acres.

Chairman: How high is our present canal up above this?

Mr. Davis: It would be almost the same level. That is, as you pass out of this lock (No. 20) you come into the same level. You drop down into here I think about eight feet below. I would like to point out to the American Section that at the present time the United States have no navigation of the Long Sault rapids save as they utilize the Canadian canal, whereas by this means the United States would be able to have in their own territory a complete system of communication, which would of course be open to Canadian navigation; and the Canadian navigation in its own waters is also improved at the same time. I think that is what Mr. Foster meant when he said that the maritime interests who had been somewhat apprehensive of this scheme were only apprehensive because they did not understand the exact details. I think that as soon as the maritime interests comprehend the project they will understand at once that the navigation is substantially improved. The South Sault channel is now practically unnavigable. I have been down several times in a boat, and it is an experience, but is about all it is—you would not want to go there regularly; whereas with this scheme the South Sault channel will be converted into a magnificent ship channel, as will also the north channel.

Secretary Wilson: What is the depth?

Mr. Davis: Down here(east) forty feet, and up here (west) about fifty-five.

Mr. Wilson: You intend to dredge near the head of the Massena canal?

Mr. Davis: Yes.

Mr. Wilson: They get about nine feet in places there.

Mr. Davis: I think right across the crib it runs to 14 feet. I have been in a boat that draws 14 feet.

Mr. WILSON: In some places it is a very tortuous channel?

Mr. DAVIS: Yes. You notice those dotted lines here. We propose to go in and rectify these areas and make a broad channel.

Mr. WILSON: So that you will have 14 feet minimum depth in that south channel?

Mr. DAVIS: Yes.

Prof. HASKELL: What is the present head of the Massena?

Mr. DAVIS: I think about 38 feet. The head varies a good deal, especially in the winter time.

Mr. STEWART: Have you any idea how many rafts go down through that south channel?

Mr. DAVIS: They are very few. I think I have a list here of everything. We have observations. I think not more than six or seven rafts, and perhaps eight or ten yachts and other pleasure craft. That is in the course of a year.

Mr. STEWART: What kind of rafts are they—square timber or mostly logs?

Mr. DAVIS: I think they are logs.

Mr. RICKEY: They are both.

Mr. STEWART: The Calvin Co. of Kingston I think do considerable.

Mr. DAVIS: As far as that is concerned, I think any lumber company would recognize that this is no detriment but rather an improvement. At the present time, as I understand it, these rafts have to be cut apart, whereas then they could go right down with a tug and go through the lock and on their way without difficulty at all. In our country a large portion of our lumber goes right through without any difficulty, as in the Alleghany river. In this way the rafts can be taken down without any breaking up at all.

Mr. STEWART: If they went through the lock they would have to be put together in a size to suit the lock.

Mr. DAVIS: Yes, but they are now of a size to suit the lock. You see, the river is so rough that any raft of any great width is broken apart, and they are now made so small that the same size will take them right through.

Mr. STEWART: There is no change in the rapids down below; they would have to leave them just the same size.

Mr. DAVIS: Yes, and consequently this would be no detriment at all, as we can see it; but the lumber interest of course is not so very large at the present time.

Mr. RICKEY: And it is growing smaller continually.

Mr. DAVIS: It is our proposition to the United States Government to construct this lock of the same size as the present Canadian locks—14 feet I think it is—and deed it to the United States Government, and provide the necessary land and the power in perpetuity for the operation of this lock. That will be our proposition when we present our Bill to Congress; and it is equally the proposition to give the Canadian lock to the Canadian Government under such restrictions as Canada will care to accept it. We propose to build this lock at the expense of the Long Sault Development Co. and deed it to the United States Government.

Mr. RICKEY: And of course we shall build the Canadian company's lock according to the regulations of the Canadian Government.

Mr. McCarthy: Mr. Freeman, a prominent engineer of the United States, has been on this work, and I think probably by reason of his experience you would like to hear him. He is available if you would like to ask any questions.

Chairman: I think the commission would like to hear anything further.

Mr. Freeman: Mr. Rickey has explained the matter so fully that I hardly see what I can add. I might say, in elaboration of what Mr. Foster has said as to the advantages at this point, instead of enlarging the present power-house, that I have reviewed that matter of seeing what could be done to obtain additional power by the present Canadian company at their present power-house or at any other point within Canadian territory, and have looked over the Hoople's creek project, and find from the surveys that have been recently made that the land in between the two branches of the stream rises to a height such as to make the excavation extremely expensive. In a rough and ready way I think it is easy for any engineer to see on going over the ground that it is a commercial impossibility to gain any power by digging a canal from Hoople's creek down into the head of this enlargement opposite Sheek Island The most practical way that I could find for adding to their present power-house was by simply building an extension on to the power-house, taking the water down just as it goes now, letting the current come down through this broad channel as it does now, and taking more water in at the head near Dickinson's Landing by enlarging the present Canadian canal to a width considerably greater than the present width. That is, it would be an obstruction to navigation to take a very much larger quantity of water through the canal than now goes through it, because the present canal now not only takes water for the lockage purposes and this power-house, but it also takes water for the supply of the Toronto Paper Co., at Cornwall, and for two or three cotton mills down at Cornwall. To add materially to that flow here would make the velocity such that it would be quite an obstruction to navigation. The channel as it is now is a tortuous one, and is exposed to cross winds and there are many reasons why it is desirable not to increase this velocity. So that the only way one could get more water down here would be practically to keep the velocity about as it is now, by making a cut on this shore of the canal. Well, it is very plain to see, as I think the engineering members of the joint commission will see when they visit the ground, that the amount of work to be done by that project would be far greater in excavation than has to be done by this project; and when one gets through developing that to the utmost of the commercial possibility I cannot see any hope of having more than a fourth or a fifth part, or some small fractional part of the power that is easily possible by co-operation with the American company under this method. It is one of the plainest cases that I have ever seen where co-operation results in a great saving of unnecessary work. Of course, half a dam across a river, or two-thirds of a dam, is no dam at all; and the topography there is so peculiar that the course of nature seems to have indicated pretty clearly what the most economical development must be if both parties would utilize this one of the resources of nature to develop it ultimately to its greatest magnitude.

Mr. Davis: Would you be willing to speak about the elimination of the ice-troubles and dangers by this scheme?

Mr. Freeman: I think there is great hope of lessening the ice troubles on this part of the St. Lawrence by this scheme of regulating the winter levels of the river. I suppose there is no large water-power site in the world where the natural difficulties from ice are greater than they are in this stretch of the river. Largely because of the fluctuation in the height of the water that arises from the wind first blowing in one direction at the outlet of the lake, and

blowing upstream for example, and tending to hold the water back, and then blowing down stream and tending to force more water through.

The result is to keep a fluctuating level along the river. There is a channel here which is continually open throughout the winter, and these fluctuating levels tend to occur continually by breaking off the border ice and bringing that ice down-stream. Then the greater the amount of the river channel that is open, the greater is the production of frazil. One reason why the water backs up at the present time ten or fifteen feet, or sometimes twenty-five feet at the foot of Barnhart island is because of the vast amount of frazil that is manufactured here in the Long Sault rapids and comes down the river mingled with the water, and banks up, forming a submerged dam at the head of Lake St. Francis. Now, anything that can be done to lessen that churning of the water as it comes over the rapids, and the forming of ice-crystals in the agitated waters, tends to lessen the production of frazil. Our studies of frazil have only been put on a scientific basis within a very few years through the work of an exceptionally talented physicist at McGill University. I think that Dr. Barnes's studies of ice formation certainly are by far the most complete and the most scientific that have ever been made anywhere in the world. Now, it is only within a few years that engineers or physicists have really come to understand the formation of frazil, and I don't know that we yet understand it fully, so I would not venture any prophecy as to the precise amount by which the winter level and the winter island gorges may be lessened; but I am entirely clear that it will be in the direction of improvement.

Mr. Davis: I would like to say that those gorges not only affect the St. Lawrence river, but they back-water up to the Grass river, submerge lands, and create considerable damage for a stretch of nine or ten miles, which would also be very considerably lessened.

Mr. Freeman: The winter level at the outlet of the Grass river is eight or ten feet greater than the summer level, due to a great extent to the hanging dams of the frazil, the ice sheets which form in the river below. I am informed in times past there has been great apprehension in the city of Cornwall from the formation of those ice gorges in this part of the river; so anything that tends to lessen this is certainly of the nature of a public improvement. One more matter I would suggest which has not appeared to be within the province of the Canadian power company but rather within the province of the Canadian Government and those who control the navigation, and that is, that if the Canadian Government authorities so desire they can, by a very small amount of work in simply deepening the upper sill of this lock, and deepening this short channel through here (indicating near Canadian power-house), do away with that lock 20, and simply increase the new lock.

Mr. Stewart: You were talking about the decreased amount of frazil ice down there. Where do you expect any frazil to come now, with this improvement?

Mr. Freeman: Some will come down the river from about Ogdensburg, from the Galops rapids, and from the rapids at Waddington, but as far as I can learn the great amount of frazil is formed here in the Long Sault rapids, in the rapid current and in the very agitated current.

Mr. Stewart: In decreasing the current there, do you think it is not possible that frazil could form further up the river, instead of going down as at present?

Mr. Freeman: I hardly see how it can. It will come down; there will still

be a current of about three feet per second down here, that will bring down whatever does form; but there will not be so much as to form these great ice gorges that have been formed down here (indicating power-house).

Mr. STEWART: The water gets down there, and as soon as it strikes the still waters of Lake St. Francis—

Mr. FREEMAN: According to my experience in the States the ice would not take across. That is, I find on the American canals that if you have a velocity more than about two feet a second, that ice does not form across the canals at Holyoke or at Lawrence or at Manchester; and as this velocity will be about three feet a second I should not expect that in this main channnel the ice would take all the way across. I think very likely in a part of these channels (west of the power-house) and in the channel immediately above the power-house it will take all the way across, and so will lessen the amount of frazil in the turbines at this power-house.

Mr. STEWART: The only question, in case anything should happen to form frazil up there, it might bring in a question of new land damages up above —introduce a condition up there that does not exist now.

Mr. FREEMAN: The condition has existed of ice frequently taking across Long Sault island. Two years ago it took across, and the ice bridge lasted there for a month, I think.

Mr. STEWART: That was a very exceptional winter.

Mr. FREEMAN: Yes, but it does take up there now.

Mr. STEWART: The frazil which takes down there is mostly formed in the Long Sault rapids.

Mr. FREEMAN: I think it largely is, yes. Therefore I think this is certainly in the nature of an improvement.

Mr. STEWART: Have you any idea how much power is to be generated by the American company with these three power-houses?

Mr. FREEMAN: That is very problematical as yet. There have got to be more surveys than have yet been made. Of course power that can be properly developed as a commercial enterprise is measured in most cases by its minimum output; that is, by the amount of power that one can have available for transmission over the country during the winter months. Now, until we have actual observations we are not in a position to say precisely what the winter level at this point will be. That is, the studies have not progressed to the point of making these estimates precise. I think it can be stated in this way—that it is perfectly plain that by this method they can get anywhere from five to, I might say easily, ten times the amount of power that they can by developing at the present Canadian power-house. It is also plain that by this general plan of development they can get more power than there is any demand for at the present time. That is, it is plain that there is water enough and that there will be power enough for anything that the present generation can foresee. So it has not seemed important to apply a microscope and try and make those estimates with great precision.

Mr. STEWART: But have you any idea of the proportion? Or is it four times as much on the American side as on the Canadian side, or five times as much?

Mr. FREEMAN: No. Mr. Davis may have that matter in hand better than I, but my thought is, here is the opportunity for the power-house, the first one on the American side and the first one on the Canadian side, practically about

the same hollow. That is, they are sketched out on the map just about the same way, and it is feasible to make them just in accordance with the demands.

Mr. STEWART: There is no such head here as there is at the Canadian power-house?

Mr. FREEMAN: No, but this head will be larger as soon as the current is checked here.

Mr. STEWART: Have you any idea what the head will be from the end of this power-house to the foot of Barnhart's island—what will be the fall?

Mr. FREEMAN: The fall is now eight feet. We might say it will be about half of the water which is diverted through the other channels.

Mr. STEWART: Have you figured out what current that will leave there?

Mr. FREEMAN: That is a matter quite largely under control, just as one draws more water one way or the other way.

Mr. STEWART: But the current in this place (west)?

Mr. FREEMAN: No, I have not made figures on it.

Mr. DAVIS: That is largely under control.

Mr. FREEMAN: It is largely under control in the early days by the sluiceways that will be provided at the ends of the dam.

Mr. STEWART: It is a question of the boats coming up.

Mr. RICKEY: I took the matter up with Capt. Cline, who has been on the boats a long time. The little steamer he operates now is the *Sirius*, a small passenger boat. He states that he can come up this river now to the head of Barnhart's island. That is as far as he can make it. That is a very small steamer. So, under the condition whereby we are generating, if there was any water in the river we would put off down at Barnhart's island, which would reduce the velocity of the water in the main channel fifty per cent, consequently the steamer could go right up there. It would not be as swift at some points up at Farran's Point, where the water is very swift, just before getting in there. There are sluices provided down at the power-houses. One object of these sluices is to rid yourselves of ice troubles, and the other is to give you a valve to open or close so as to discharge the water, so as to make this navigable channel.

Mr. MCCARTHY: Does the Canadian section realize that we Canadians at the present time have only the water which is taken out of the river above those rapids going through the canal—that that is the only means on our side of going up and down?

CHAIRMAN: We quite understand that.

Mr. MCCARTHY: By this proposed scheme you have two channels.

CHAIRMAN: If your argument is true it will be unnecessary at all to go all this circuit.

Mr. MCCARTHY: Yes. You can go that way (north) which is entirely Canadian, or go this way (south) which is international.

CHAIRMAN: We have listened with great pleasure to what you gentlemen have said. This thing has evolved out of a very small beginning. The first time we had this matter before us it was an application for a small power on Barnhart island. It has greatly enlarged until it is a very big thing.

Mr. Davis: I would like to say that the committee which appeared before you had an idea that we would buy them out—which we did. (Laughter).

The delegation then withdrew.

The commission adjourned at 1.15 p.m.

APPENDIX B.

INTERNATIONAL WATERWAYS COMMISSION

MEETING OF CANADIAN SECTION

PROCEEDINGS OF PUBLIC HEARING.

St. Lawrence Power Co. and Long Sault Development Co.

Montreal, Wednesday, Nov. 6, 1907.

The Canadian section of the commission met in the Council Chamber of the Board of Trade at 10 a.m.

Present—George C. Gibbons, Esq., K.C., Chairman; Mr. Coste, Mr. Stewart, Secretary Thomas Coté.

Deputations were present from the Shipping Federation of Canada, the Montreal Board of Trade, the town of Cornwall, and representatives of the St. Lawrence Power Company and the Long Sault Development Company.

The Chairman.—Gentlemen, the International Waterways Commission, the Canadian section of which is here to-day, have had an application for a very important undertaking in the St. Lawrence river—the development of power by two companies, the United States company being known as the Long Sault Development Company, and the Canadian company as the St. Lawrence Power Company—near Cornwall, Barnhart island and the Long Sault rapids. The general Commission on International Waterways have agreed upon certain principles governing these boundary waters. They have agreed that, in places such as the St. Lawrence river, Sault Ste. Marie and other boundary waters, where there is a stream partly in the territory of each country, if it be at all possible to make use of the water power without injury to the interests of navigation, that it should be permitted in such a way as to have the benefit distributed equally between the two countries as far as possible. The interests of navigation are to be in all cases paramount, and subject only to the right of use of the water for domestic purposes. That is to say, that where water is taken at Sault Ste. Marie, one-half of the power of the surplus water that can be taken without interfering with navigation should be reserved for the use of the Canadian people. That principle has been adopted by the general commission. Now this application comes before the International Waterways Commission, being an international matter, and has to be dealt with by both governments. Of

course, it is the desire of the commission, and in the public interest, that where power can be developed without injury to paramount rights of navigation it should be permitted; but if there be interference with those rights, of course it cannot be allowed. We had these gentlemen representing the power companies before us in Toronto, and it was thought desirable by the Canadian section, that the Montreal Board of Trade, so heavily interested in the navigation of the St. Lawrence, and other interests which might be affected, should have an opportunity of hearing from those who are interested in this scheme, just what they propose, and that we should have the benefit of their opinion with regard to it, either now or later on. It is a large matter, not one in which I think it is desirable to act too hastily. The commission want to get the very best assistance they can, expert or otherwise, and then to decide in advising the respective governments regarding this undertaking in accordance with the principles which the commission has already adopted. I think perhaps it would be best now that we should call upon Mr. Foster to explain just what is proposed to be done by this company, and then we will hear in turn any other interests that are represented.

Mr. Geo. C. Foster.—As president of the St. Lawrence Power Company, I do not think it is necessary for me to say anything to you other than to furnish you with the explanations that our engineer will give in regard to what we propose to do. Suffice it to say that if our works as now contemplated are carried out, it will mean so far as Canada is concerned, the investment of a large sum of money and the development for commercial purposes of something that is to-day useless so far as those rapids at Cornwall are concerned. We do not expect from this commission, or from anybody else, any unfair criticism; and we are quite prepared to put before you every detail and plan that we propose to adopt, because we are instructed by our engineer that not one dollar's worth of work that we anticipate doing is going to interfere with the paramount question of the navigation of the St. Lawrence either above or below Montreal. I am aware that during the last few days it has been stated here that the works which we contemplated at Cornwall are going to seriously interfere with the navigation of the St. Lawrence below Montreal; and I am going to admit to you frankly on the start, those of you who are shippers and interested in this question, that so far as our plans are concerned they not only do not contemplate such a thing, but that if it can be shown that they do, we do not expect anything but opposition from the Montreal Board of Trade and from the shippers who are interested in that route. And it is because I feel so confident that the position which our engineers have disclosed to us is the true one, as well as the result that will follow from these works, that I tell you frankly we are prepared to put before you everything connected with it now and for the future. And if in the future the Board of Trade of Montreal or the shipping interests of Montreal have reason, or think they have reason, to fear seriously the result of the work we are doing at Cornwall, we shall at all times be prepared to put before you every detail connected with that work. I would ask our engineer to put the matter before you in a technical way.

J. W. Rickey.—Gentlemen, the general scheme as proposed by the St. Lawrence Power Company for the development of power at the Long Sault rapids is, briefly, the construction of two dams—one across the main channel of the St. Lawrence river and the other across the secondary channel of the St. Lawrence river. Through the main channel of the St. Lawrence approximately, 96 per cent of the water passes, through the secondary channel, which is an international one, the other 4 per cent passes. The construction of these dams will throw approximately 50 per cent of the water into that international channel where now only 4 per cent goes. The scheme calls for the

co-operation of both governments. Without such co-operation no power can be developed in the main channel of the St. Lawrence river, other than such power as is now developed by the St. Lawrence Power Company near the town of Milles Roches. The Long Sault Development Company, a United States corporation, has a charter from New York state under which it may construct a power plant in south channel of the river, by which channel I mean the channel south of Long Sault island. This plant will be entirely in American waters, and would not interfere in any way with Canadian interests, any more than the present St. Lawrence Power Co.'s plant interferes with United States interests. (A map of the section was placed on the wall, and the various points referred to were indicated.) Ninety-six per cent of the water goes down through the South Sault, in United States territory, and the main channel north of Long Sault island. The 96 per cent then, having passed the international boundary line, passes entirely into United States territory on the south side of Barnhart island. The other 4 per cent passes through what is called Little river, which is the channel between Barnhart island and Sheek island until it gets to the east end of Sheek island. Then it joins the other 96 per cent.

The proposition of the St. Lawrence Power Company is to have a power-house near the east end of Barnhart island in the present secondary channel of the river, that is, the Little river channel. This north end will abut against the Canadian shore, then extending westerly will join the V-shaped dam running westerly, and the other end of the dam will run southeasterly to the international boundary line. That much of the power-house and dam is entirely in Canadian territory. The scheme further proposes to construct a new lock, about half a mile above present lock 20. This map was made to show that without the co-operation of United States interests no power could be developed from the Long Sault rapids, except the power that is available from the South channel. Let us assume this power-house and dam constructed as far as the international boundary line. All the water that is now going through the Long Sault rapids will continue passing down the present channel on the south of Barnhart island. The same amount of water which now goes through the Little river channel will continue there. That water, approximately 10,500 cubic feet per second, will come down as far as this V-shaped dam on the easterly end of Barnhart island, and would then pass through the gap between the boundary line and Barnhart island. That gap would be about 300 feet wide. That being the case, we have created no elevated pond. We have only the same amount of water that has been there in the past, and no power could be developed from this plant at all. I will now put up the other map, which shows the combined scheme. (Large second map is placed on wall.) This map is a tracing of the greater part of the former map, except that the proposed improvements on the south side of the international boundary line are here shown. All that is north of the international boundary line is just the same as it was on the other map. You will note a dam is proposed by the Long Sault Development Company extending from the north end of Barnhart island over to Long Sault island. Further, at the V-shaped dam at the easterly end of Barnhart island there is a second dam about 500 feet long running from the international boundary line and abutting on or against Barnhart island. Likewise, in South channel is shown the proposed power-house of the Long Sault Development Company and the United States lock. This is the power-house to which I referred when I stated that the Long Sault Development Company had a charter from the State of New York authorizing the construction of this dam under certain limitations. Now, let us assume that this power-house and lock are constructed; that this upper dam is constructed; likewise the V-shaped dam, or the lower dam, is constructed; what will then be the result?—The water of the river above the Long Sault Development Company's power-house and above these dams will then rise until it attains such a depth on the crest of the dams that all the water will pass over them, the power-houses being assumed not in operation.

That will mean the depth of the water on the crest of the dam will be approximately 5 feet, and we propose, subject to the permission of you gentlemen, to raise the level of the future pond five feet above the present level in the Cornwall canal on the north side of Sheek island. I referred a short time ago to the lock in Canadian territory at the east end of Sheek island, and about half a mile, roughly, above lock 20. This lock, it is proposed to build entirely at the expense of the St. Lawrence Power Co., subject to approval, and if you please, of the Department of Railways and Canals. We propose, subject to your approval, to construct a channel along the lines or course of the present Little river, this channel to be approximately 800 feet wide. The velocity of the water in that channel will be about 3 feet per second, so that a boat having passed from Cornwall up the present Cornwall canal and through lock 20, thence half a mile westerly, will pass through the new lock to be constructed at the St. Lawrence Power Company's expense. Then it can pass in almost a straight line, under full headway, up the river. The boats passing through the present channel, after clearing lock 20, follow the route that I will indicate with the pointer, through this tortuous channel, past the swing bridge into the circuitous channel on the north side of Sheek island, then at the westerly end of Sheek island enter a narrow channel, and navigate it for a distance approximating four miles, that is the upper end of the Cornwall canal, and through lock 21. I think it will be plainly evident to all interested, that this channel between Barnhart and Sheek islands—this channel being anywhere from 30 to 40 feet deep and 800 feet wide—will offer a most excellent channel for navigation, where boats can come down under full headway to within a reasonable distance of the lock, when of course they have to slow down, as compared to the narrow channel on the north side of Sheek island and the Cornwall canal above and westerly from Sheek island. Now, coming to the United States side of the question, the United States government will insist on the co struction of a lock joining the power-house of the Long Sault Development Company at the foot of Long Sault island. This will be a single lift-lock, making the entire rise that is now accomplished by six locks in the Cornwall canal in a single lift. I have had some observations made on the time of passage required for boats through the present Cornwall canal. Just taking the boats at random, I put a man there and told him to take every boat he could get on. I found that the shortest time was three hours and fifteen minutes and the longest was six hours and forty-five minutes. The time in passing through the lock was about 15 to 17 minutes roughly, which could be reduced a little below that.

There being six locks, 6 times 15 are 90 minutes, or an hour and a half, that is required for the passage of these boats simply through the canal. Having passed through the locks, as I understand the Canadian law, the legal limit is 4 miles per hour for the passage of boats in the canal. As a matter of fact, I think the shipping interests go considerably faster than that, but the legal limit is that. The main time spent is in passing through the lock slowly and leaving it slowly. The time after leaving the sluice gates is comparatively short; so that the United States lock should not require more than 20 or 25 minutes or half an hour. That means a saving of one hour on the downward trip, due to the United States lock. Having passed the United States lock, boats then enter the main channel of the St. Lawrence river, where the water according to the United States government charts, is anywhere from 40 to 60 feet deep. This channel at its narrowest point will be over 1,000 feet wide so that boats can pass each other at full speed. Now, the question may arise here, the current on the south side of Barnhart island is now very swift. No ordinary craft would care to come up against that. It is as swift as it is up near Farran's point. When we construct the upper dam that crosses the main channel of the river from Barnhart to Long Sault island, and also the V-shaped dam at the east end of Barnhart island, we will pass more than half the water in the river over the dam at the east end of Barnhart island. As a

consequence of this, the water, instead of following the present main channel of the St. Lawrence river south of Barnhart island, about half of that water will be deflected—in fact a little more than half will be deflected—into the present channel of Little river, which it is proposed to enlarge and rectify, and also into the channel on the north of Sheek island. I will take up in just a moment how the water would get under there under our proposed scheme. If we diminish the amount of water in this south channel that is entirely in United States territory by 50 per cent, we will decrease the velocity approximately 50 per cent. I have had current meter measurements made in this channel, and it is estimated that the velocity will be approximately 4 to 4½ miles per hour, which is considerably less than is obtained in many other stretches of the river. So that boats leaving Cornwall will have no difficulty in coming up the river through this channel and through the United States lock. However, I wish you to bear in mind that the integrity of the present Cornwall canal system is to be maintained. The boats, having such access, can pass up the Cornwall canal through the present lock 20, through the new lock which takes the place of lock 21; then if the captain should choose, he can go on the north side of Sheek island in the present Cornwall canal, or through the 800 foot international channel. It is proposed, with your permission, to remove the dam between the easterly end of Sheek island and the main shore that maintains the water in the present Cornwall canal at a higher elevation than the water in the main channel of the river immediately south of it. It is likewise proposed to remove the dam at the westerly end of Sheek island. The object in this is two fold—in order to get 50 per cent of the total amount of the water in the river down to the lower end of Barnhart island it is necessary to have very deep and very wide channels. Here is a channel that is already excavated, and by availing ourselves of that channel, by the removal of those two dams, the velocity of the water in what you might call the proposed Little river section will be exceedingly slow, so that boats will not have the slightest difficulty in coming against the current of about two miles per hour—three feet per second is what the figures call for.

Mr. Foster referred to the statement that seems to have gained ground to a greater or less extent, that the operations which we are proposing would diminish the volume of water in the St. Lawrence river at Montreal. Let us assume these dams built—the upper dam between Long Sault and Barnhart islands, and the lower dam as described previously. There is no pond or lake in which to store the water that is coming down the river. We have to pass it over those dams just exactly as it comes. If there are adverse winds that retard the water, then not so much water passes over the dams. If there are favourable winds coming down stream, then more water will pass over the dams. It seems almost axiomatic that simple obstructions placed across the river, as indicated here, with no storage pond to speak of, above the dams, that there can be no reservoir effect above there; consequently the normal flow of the river will obtain under the conditions proposed just the same as they do now. This fact seems so evident that I will not take up the time of you gentlemen to discuss it further, although if anyone wishes I would be very glad to enlarge on it.

There is one more consideration—the subject of frazil ice in the river. Generally speaking, the ice which forms the jams and ice bridges in the main river opposite Cornwall are caused by the Long Sault rapids. The water comes down at a temperature slightly below 32 degrees, due to the excessively cold weather. In passing over the rapids, the agitation that is there set up causes an immediate formation of those crystals of frazil ice. It is a long, narrow crystal— it is just like slush, like snow that is put in the water. This frazil ice, passing down the main channel, reaches Lake St. Francis. The velocity there is very much slower, and the ice lodges there. Then more coming down, it just packs right in solid. We have observations showing that the rise of

water in the river a short distance above Cornwall bridge in 1883, if I mistake not the date, I have a record of it in my book, rose practically 30 feet. In 1892, it rose 27 feet. I am informed by citizens of Cornwall that the winter floods caused by ice have reached up as far as Fifth street. It is also a well known fact that in the present plant of the St. Lawrence Power Company there is practically no trouble from frazil ice. The reason for that is, that this channel on the north side of Sheek island freezes over. The minute it freezes over, the ice floe protects the water from further reduction in temperature, and the velocity of the water being reduced the formation of frazil ice is prevented. Now, bearing these principles in mind—and it is no theory of mine, but it was very elaborately set forth by Dr. Barnes, of McGill University, who has written a very learned monograph on the subject, and any of you gentlemen who are interested in the subject of ice will find no better statement of the conditions than are set forth in that book—the construction of those dams will create a pond above the dams, so that the velocity of the water will be very materially reduced, due to the raising of the present surface of the water, the river channel being the same width. Consequently, the velocity being reduced, we will not have the turbulent water which now passes down the Long Sault and the formation of frazil ice will thereby be prevented to a very great extent. It will not be entirely prevented, but to a very great extent. The same principle obtains in connection with the power-house of the Long Sault Development Company, so that the great ice-making machine that is there now will be obliterated—and it means much to Cornwall interests.

It is proposed, subject to your approval, to remove the present dyke on the south side of the present Cornwall canal, west of Sheek island, the object being to get additional waterway on the north side of Long Sault island, which is now the main channel of the river, so as to reduce the velocity of the river in that channel as much as possible.

Coming now to the new lock which it is proposed to build above half a mile above lock 20. Northerly from this lock would be constructed a dyke approximately 100 feet wide on top. The function of this dyke will be to enable us to abandon this short circuitous length of canal between the enlarged Cornwall canal section and the present canal just above lock 20. The dykes of the present Cornwall canal are approximately 16 to 17 feet wide on top, and down here opposite Fletcher's hotel they restrain a head of roughly 30 feet. I have examined these dykes many times, and they are practically bottle-tight, with a head of 30 feet against them. We are proposing here to have a head of but five feet against that dyke, and a crest width of about 100 feet removing without any peradventure the possibility of a break occurring through them. In order to absolutely protect the interests in the Cornwall canal below lock 20, regulating works could be installed there to discharge the water from the canal down into the main channel of the river. Likewise provision can be made through the dyke, as indicated here, whereby the present amount of water that is supplied to the water power interests at Cornwall could still be maintained. Or, if the government saw fit and chose to, more water could be supplied to those interests than is now the case.

Mr. MACAULEY.—May I ask one question. Will you please let us understand what is proposed at the foot of Barnhart island? You are proposing, apparently, to excavate two new channels, and what looks like a dam at the foot of that, which would mean a complete damming of the waters of the river. I see a new dam at the foot of that channel?

Mr. RICKEY.—That is the power-house there.

Mr. MACAULEY.—Including a dam?

Mr. RICKEY.—The power-house itself acts as a dam.

Mr. MACAULEY.—So that the result is three dams—the upper one, the one between locks 20 and 21 and this one at the end of that new channel; together with the other one at the end of South channel, which really completely bar the river?

Mr. RICKEY.—Absolutely. If we did not bar the river we could not develop any power. That is true.

Mr. MACAULEY.—One result of that will be no longer any such transit as is now made by the boats of the Richelieu and Ontario Navigation Company?

Mr. RICKEY.—No, sir, they cannot go down the rapids.

Mr. FOSTER—There will be no rapids.

Mr. RICKEY.—I lived some years at Sault Ste. Marie, both Michigan and Ontario, and was struck with the large number of visitors that stopped there every summer just to see the passage of boats through the locks. They could visit the United States and then go to the Canadian side. Now, one of the chief features of the pleasure tours that are offered by the R. and O. Navigation Company is the passage of the rapids in the river. Including the Long Sault rapids, there are four sets of rapids between the upper end of Barnhart island and Montreal. Our work here proposes absolutely obliterating the Long Sault rapids. On the contrary, the people coming on that pleasure trip will pass down through a lock that has a higher single lift than any lock that I know of on the American continent.

Mr. C. J. SMITH.—Will it be opened Sundays?

Mr. RICKEY.—Yes, sir, it will be open Sundays.

Mr. SMITH.—That is, in the United States.

Mr. RICKEY.—The United States lock will open on Sundays. Moreover, they will see a dam that will be second to none in the world—and I believe I am perfectly correct in that statement—there will be a depth of from two to five feet on the crest of the dam, falling 40 feet. That will be a sight that will be worth travelling many miles to see. Take the case of Niagara falls. The fear was entertained that the so-called power enterprises there would interfere with the scenic beauty of the falls and diminish the amount of tourist travel there. On the contrary it has gradually increased, and the citizens of Niagara Falls, who were financially interested there before, are making more money now, I believe almost without exception, than they did formerly.

Mr. KING.—(Secretary Dominion Marine Association). The point is new to me. I do not know whether it has occurred to my friend Mr. Smith, who is so interested in the R. & O. Co.? What provision is made for rafts?

Mr. RICKEY.—Rafts will go through this lock on the United States side.

Mr. KING.—What will be the size of the lock?

Mr. RICKEY.—That has not been determined, but it will be compatible with the entire Canadian system of locks.

Mr. KING.—But they do not go through the locks.

Mr. RICKEY.—I understand they do not, but that lock will be made wide enough to take care of the present traffic of the river, and any reasonable anticipation. The United States government will insist upon that.

Mr. KING.—Any reasonable raft.

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Mr. RICKEY.—Any reasonable raft. You cannot make those rafts of exceedingly great width, because in passing through the various rapids they would be broken up. Now, the way the rafts come down the river at present is for a tug to bring them down to the upper end of Long Sault island. There they are broken up. The rafts are cast loose from the tug, and go down, trusting principally in Providence. After arriving in the main channel of the river at the west end of Barnhart island they are again made up. Coming down in the proposed channel they would enter the lock on the United States side without being cut loose from the tug, and then on down the river. Now, we have had observations made as to the number of rafts and craft that have passed down the river in 1905 and 1906. From June 20, 1905, to October 20, 1905, there were seven trips of tugs accompanied by rafts; there were 21 pleasure boats. For the year 1906, from April 22 to November 23 inclusive, there were tugs accompanied by rafts, 17; tugs alone, 5; tug and scow, including one tug accompanied by a dredge 4; pleasure boats, 21.

Mr. KING.—You mean 21 separate boats or all of one name?

Mr. RICKEY.—No, there were 21 separate boats going down there.

Mr. KING.—In the season?

Mr. RICKEY.—Yes, this is South channel I am talking about. In the main channel, as I understand it, R. & O. Navigation Company steamers ply for about three months.

Mr. SMITH.—They ply longer than that; they ply the Long Sault rapids the season of navigation, whatever that may be, whatever we choose to make it. The Long Sault is a navigable stream, and not only Long Sault boats—

Mr. RICKEY.—It is not a fact that the R. & O. boats are the only boats that go down?

Mr. SMITH.—Oh, no.

Mr. RICKEY.—How long is a season for the R. & O. boats to go down there?

Mr. SMITH.—We can run the Long Sault rapids the entire season of navigation.

Mr. RICKEY.—What is the number of months?

Mr. SMITH.—Roughly speaking, seven months. I do not say they always do. There is no trouble to run the Long Sault rapids at all.

The CHAIRMAN.—What amount of horse-power do you propose to develop on the Canadian side, and how much on the United States side?

Mr. RICKEY.—That is a subject that is under investigation at the present time. The proposed power-house on the Canadian side would have a capacity of approximately 50,000 horse-power. That power, gentlemen, is the same power as in the city of Minneapolis, a town of 300,000 people. It is more than the combined power of Lowell, Lawrence and Manchester put together. When we say 50,000 horse-power it does not convey much of an idea. It is like speaking of $10,000,000. It is when you come to analyze it that it means something which will supply all this adjacent territory up stream and at Cornwall for many years to come.

Mr. SMITH.—50,000 horse-power?

Mr. RICKEY.—Yes.

The CHAIRMAN.—How much on the United States side?

Mr. RICKEY.—There have been no estimates made. I have men now gauging the river to determine the amount of water. Until we know the amount of water we can neither get the exact head under which the plants will operate, nor can we determine how much power will be available.

The CHAIRMAN.—It will be much larger though.

Mr. RICKEY.—Yes.

Mr. MACPHERSON.—How much are you going to raise the level in the neighbourhood of Barnhart island? Is it necessary to have any side dams to prevent the drowning of lands or the diversion of the river into other channels?

Mr. RICKEY.—As a general thing the banks are very steep, so that the overflow of land is comparatively little. I presume that later on a member of the Long Sault Development Company will state exactly what lands have been acquired by the United States company, and also we can ascertain the amount of land that has been acquired by the St. Lawrence Power Company. Answering the question in a general way, the pond will be raised five feet above the present level of the Cornwall canal.

Mr. MACPHERSON.—Above the present level of the river?

Mr. RICKEY.—Above the present level of the river at the end of Barnhart island, about 40 feet.

Mr. MACPHERSON.—Head?

Mr. RICKEY.—40 feet head. I wish it to go on record that that is not exact. As I said a while ago, those computations are being made, and it involves a great deal of labour.

Mr. MACPHERSON.—Are any side dams required? Any dykes?

Mr. RICKEY.—Yes. There is a dyke here, and so marked on the map. There is a dyke adjoining the Canadian power-house. That is the dyke to which I referred a while ago, that will be 100 feet wide on top, built under the specifications and approval of the Canadian Government.

Mr. MACPHERSON.—That is the only dyke?

Mr. RICKEY.—That is the only dyke.

Mr. MACPHERSON.—On either side of the river?

Mr. RICKEY.—Yes.

Mr. W. B. MACAULEY.—There is a question occurring to me here. The various dams that are being put up, as I understand, will cause the chief, if not the entire body of water to come apparently into the Canadian channel. How much will that raise the water summer and winter?

Mr. RICKEY.—Approximately 40 feet above.

Mr. MACAULEY.—What is the rise in the winter of the water of the river down here (power-house)?

Mr. RICKEY.—I cannot answer that question exactly, in a general way; it is about 15 feet in the average winter.

Mr. MACAULEY.—My reason for asking that question is this—it did not occur to me before, but hearing the remarks made here—the difficulty of getting a supply, that is of using the canal water in winter, is owing to the frazil ice blocking up the fall of the canal water, and in that way preventing it being of use. Now, if this is to raise the water higher in winter, then we shall be compelled to utilize all winter the power from further up. What I mean is this: At the

present time the supply of power by the St. Lawrence Company in the winter is entirely done away with during the time that the back water below, from the ice that accumulates there, prevents the frazil ice going away; and it raises the water so high as to be equally as high, or about as high as the water in the canal. The result is that we cannot use the water of the canal, and have to fall back upon the power that the St. Lawrence Company supplies. Now comes the question, will this raise the water during the whole winter, and in that way prevent our utilizing the water of the canal, and compelling those using the canal water to fall back upon the St. Lawrence Power Co. for power for the whole winter?

Mr. RICKEY.—In answer to that question, I will repeat the remarks which I made a short time ago relative to the formation of frazil ice opposite the town of Cornwall; the ice being formed in the Long Sault rapids dams up the water at and above Cornwall and backs up in the tailrace of your mills, if you please. When these dams are constructed the formation of frazil ice will be very greatly diminished and the damming up at the head of Lake St. Francis or in your tailrace will be very much less, and you will have a very much better condition under this regime than you have now.

Mr. MACAULEY.—Why?

Mr. RICKEY: Because it is the frazile ice that forms the ice dam down there and backs the water up your tailrace. If we do not have the frazile ice the tailrace water will not back up, and it is the backing up of the tailrace water that diminishes the head in your plant.

Mr. DAVIS, (President of the Long Sault Development Co.)—I think Mr. Macauley's conception is that the present tailrace comes in at the proposed high level. The fact is the tailrace of the various companies utilizing the power on that canal go in below not above those dams, so that whatever water goes in above those dams makes no difference.

Mr. E. O'CALLAGHAN (Cornwall).—The formation of this frazil ice is just opposite the town of Cornwall. When it freezes below Cornwall it has a different effect from above. You cannot guide the formation of this frazil ice except just as it is formed in the fall. Seasons differ.

Mr. COWIE.—What is the drop from Lake Ontario to the Sault Rapids?

Mr. MARCEAU.—I think it is a couple of feet.

Mr. COWIE.—Will not this back up Lake Ontario?

Mr. RICKEY.—The pond that we propose will back the water up to the head of Croil island. That being the case the current at present at Farran's point will be greatly diminished, which will be a decided benefit to navigation.

CHAIRMAN.—Will it affect the level farther than Farran's point?

Mr. RICKEY.—I cannot answer those questions directly. There are so many details that I cannot bear in mind.

CHAIRMAN.—Would that have an injurious effect?

Mr. RICKEY.—It would be an advantage if we could get the water down here at the low season. If we could back up Lake Ontario at the high water and get the water down here at the low water it would be an advantage to navigation.

Mr. STEWART.—The fall between Lake Ontario and the head of the Cornwall water is somewhere about 45 feet.

CHAIRMAN.—Are there any questions, or does anybody else desire to address the commission?

Mr. C. J. SMITH.—I would like to have the estimated cost of this plant—both development companies combined.

Mr. FOSTER.—As our engineer has already told you, we are not in a position to-day to say to this meeting, nor to our own associates, what the cost of this is going to be, and there may be some difference in the actual cost of it and the estimates we make of it; but the probability is that so far as the Canadian end of it is concerned it means an expenditure roughly in the neighbourhood of $5,000,000.

Mr. RICKEY.—That is the expenditure in Canadian territory.

Mr. FOSTER.—By the Canadian company in Canadian territory, which is the only place where they are going to spend any money, and in the purchase of the lands which we have already acquired, and flowage rights, etc., which are in the neighbourhood of something like $100,000.

CHAIRMAN.—Are there any other questions, or does anybody desire to hear further from the promoters of this scheme?

Mr. MARCEAU.—I would like to correct a statement I made just now about the drop between Lake Ontario and this plant. When I said two feet I meant at the head of the rapids. This is considerably lower than the head of the rapids. I am not prepared to say what would be the fall from Lake Ontario to this point.

Mr. CAMPBELL.—The town of Cornwall is represented here by a delegation appointed at a meeting of the Board of Trade of Cornwall, which has 200 members, and this resolution was unanimously passed, and the delegation was sent down to support the scheme:—

'Moved by N. J. Fraid, Vice President;

'Seconded by J. A. Macdougal:

'That whereas the Cornwall Board of Trade have learned that a meeting of the International Waterways Commission, Canadian section, is to be held at the city of Montreal, on the sixth day of November, at 10 o'clock A.M., for the purpose of presenting before those interested in the navigation of the St. Lawrence, the proposal of the contemplated works of the St. Lawrence Power Company at the Long Sault rapids in the vicinity of the town of Cornwall.

'And whereas the Cornwall Board of Trade feel that the development of the water power at or near the town of Cornwall would be greatly in the interests of the town of Cornwall, county of Stormont, and the eastern portion of the province of Ontario.

'Therefore the Cornwall Board of Trade authorizes and empowers the following representatives from among their number to attend at said meeting and to advocate for and urge upon the commission the importance of assisting in the development of power at or near Cornwall.

E. CAMPBELL,
President.

F. BISSETT,
Secretary Cornwall Board of Trade.

Mr. CAMPBELL.—Mr. Smith, a member of the Board of Trade will speak on behalf of the Cornwall board.

Mr. ROBERT SMITH (Cornwall).—Mr. Chairman and gentlemen, I do not know that I can add very much to what is already stated in the resolution; but I may say that the town council of Cornwall have passed, as I understand, the same resolution, and I think the mayor is here. From the point of view of the town of Cornwall—which as you know is a somewhat large manufacturing town—the development of power is a very important question. As conditions prevail there now, we are deriving a certain amount of water power, for the running of the

mills, directly from the Cornwall canal. Power is also developed for other purposes, such as street railway, electric lighting, &c. One of the difficulties that the owners of those powers have to contend with at the present time is the back water, that has been alluded to. That back water rises to a very great height at times in Cornwall, sometimes as high as 50 feet. We have had the town flooded. Of course, when the back water comes up, there is no power, and those mills and other industries must have supplemental steam plants to run their factories during that time. Except that reasonable supplementary supply, the power has been obtained from the St. Lawrence Power Company, which in some places has taken the place of steam plants. The proposed scheme will greatly benefit the existing powers as I understand it, from an engineering point of view by reason of preventing this ice from going down and creating a dam. At all events it is represented by the engineers in a technical way that that ice dam at Cornwall will be prevented, and in that way the head of the present power developed at the canal will not be obstructed in winter, and the result will be that the power will be continual the year round. That is a very important consideration from that standpoint. Beyond that the power at Cornwall is limited. There is not, I understand, a single horse-power available in addition to what is now being used, even from the St. Lawrence Power Company. That is, they have already sold all the power they can develop under present conditions

Mr. CHAIRMAN.—About how much is that?

Mr. FOSTER.—1,250 horse-power.

Mr. ROBERT SMITH.—That places the town of Cornwall in a very awkward position. We are not in a position to offer any inducements in the way of power to any manufacturer coming to Cornwall. Therefore, any one can see the vast importance of any scheme that will develop 50,000 horse-power right in the neighbourhood of the town. We will then be in a position to offer inducements to industries coming to the town, which can only now develop power by means of steam.

The MAYOR OF CORNWALL said: It was understood by the council and the Board of Trade that Mr. Robert Smith, who has just spokem, would represent us.

The CHAIRMAN.—Are there any others to be heard in support of this proposal? Are there any who desire to say anything in general criticism, in opposition or otherwise?

Mr. MARCEAU.—I have been directed to come before the board on behalf of the Department of Railways and Canals, and I have written here a little statement:—

'The department has no particular opinion to express with regard to the proposed power project, in favour of it, at any rate, at the present time. But it is opposed to it as exposed through the press.

'No plans were submitted to this department to enable an intelligent opinion to be formed.

'In the absence of full working plans, showing exactly what is contemplated, the only action we can take is to object to the International Waterways Commission giving the proposed company any rights on the St. Lawrence and to oppose any interference with the river's regimen as established.

The CHAIRMAN.—Have you made this report to the minister?

Mr. MARCEAU.—No, I did not make this report; I was directed by the chief engineer to come before this meeting and impress that.

The CHAIRMAN.—I would like to hear everybody on this subject In opening this meeting I forgot to mention and I mention it now for fear anybody would go away— that we want the representatives of the Montreal Board of Trade and all interested in navigation to remain with us either when we finish this morning, or this afternoon, to hear a still more important matter about which we propose to consult you—the proposed dam in the Niagara river. The principle there is the same. It is conceded that it must not be built if it will be injurious to navigation in the Lower St. Lawrence, but if it can be built so as to improve navigation without injury below, it should be done. But it is so important a matter that I mention it now so that no one who is interested in any way in navigation may go away. Are there any other representatives of the Montreal Board of Trade who will address us on the subject of the power development in the St. Lawrence?

Mr. ESDALE.—As chairman of the navigation committee of the Board of Trade I heard with a great deal of interest the details of this scheme. The council of the Board of Trade associated with me in this matter James A. Tuttle, manager of the Montreal Transportation Company, who is better posted on the river, and I will ask him to speak. I would like to impress the fact that the board has always taken a strong stand that the government should not sanction any work in any way or shape on the river that would in any way interfere with the waterways for inland or oversea traffic. The government have already spent millions on our international waterways, and we feel very strongly before anything should be done it should be gone into in the most thorough manner, so that there would be no danger of a fraction of the water being taken away from the waterways.

Mr. TUTTLE.—I feel a little embarrassed, because I am neither an engineer nor have I the technical knowledge necessary to address you on this subject. I think what Mr. Esdale says is the main point of the Board of Trade. They do not wish in any way to hamper any trade or the development of any scheme that will be for the improvement of the navigation of Canada. On the other hand if this be permitted to go through we may find that the St. Lawrence, east of Cornwall, is down some three or four inches. Now it is quite true that by damming this stream theoretically the same water will go over the top and the same depth of water will be below. I understand that it does not always occur. When these dams are put in a certain small amount of water gets drained off by canals in some way not accounted for, and the same amount of water does not run over that ran in a free manner. The result is that the lowering of the water in Lake St. Louis or Lachine rapids, where we are forced to use 13 ft. 10 in. is going to affect navigation in a very serious manner—not only for river vessels, in which I am interested, but lake vessels, and all traffic coming through from the great lakes. The government have been good enough to give us a 14 foot channel, and we utilize it. Suppose it is reduced to 13 ft. 9 in. or 13 ft. 6 in., it is going to cut the vessel's load down, right down from Fort William or Duluth, as the case may be, to Montreal. I think the St. Lawrence Power Company—I am not trying to find particular fault with them—are not friendly to navigation. Rather, over every vessel passing through the canal, they hold, I think, one of the greatest menaces in Canada to-day. They have a contract with the government for 80 or 90 or 100 years by which they are obliged to pull every vessel in and out of each lock. This may not be the place to bring it up, but this is the company that holds the contract, and I think we should deal very carefully, and very slowly, and employ the most expert man that can be found, as no doubt yourselves and the government will do, before any permission is granted to this company. They are to-day making almost a tailrace out of the Lachine canal from their own works to the head. What

they are not doing the balance of the manufacturers along the canal are doing. You take lock 17 in that canal. I think the west weir there has diverted more vessels, caused more accidents, and caused the insurance companies more loss than probably any place outside of the entrance to Farran's point canal on the River St. Lawrence. As I understand it, these canals, and these channels that were dug were principally for navigation, they are not for water-power schemes; and the navigation should be protected. The scheme they have to-day of drawing vessels in and out of the Cornwall canal is delaying us at least from 10 to 12 hours to pass through that canal, where we should do it in 3, and it seems there is no means of getting quit of this for ninety years, when we will all be dead. (Laughter.) Now, I think we ought to go a little slow in granting any greater powers If they dam up the south side opposite Farran's point there, as I understand it, it will force vessels that to-day use Farran's point canal, or rather, that have been using the slide, to go outside. It is going to increase the current there, and it will force vessels to go through the canal, all sizes. That is one of the worst places for a large vessel to enter, and they have been in consequence using the slide. If it is not going to interfere with that I do not wish to make any objections to it. I do not know that I can put this matter in detail at all, any more than to express my own opinion that nothing must be done that will lower the levels of the water east of Cornwall.

The CHAIRMAN.—You can rely upon that. I said at the opening that the principle agreed upon by both sections of the commission, United States and the other, is that the interests of navigation are paramount. The only idea was that we should allow public improvements consistent with that, but not otherwise. It is to get at some means of finding what the truth is that we are holding this meeting.

Mr. FOSTER.—In reply to Mr. Tuttle, I want to say to him and those interested in this matter from the commercial standpoint, who are prepared to deal with it in a fair spirit, that so far as the St. Lawrence Power Company is concerned we are advised, and we believe, as stated in my opening remarks, that the work which we are going to do is not going to interfere in any way, but that it is going to benefit navigation of the St. Lawrence above Montreal and not hurt it below it, and I make this statement to Mr. Tuttle now, that, so far as his reference to the slide is concerned, our information is that we are going to benefit the very danger that he refers to. So far as the question of submitting it to the engineer, etc., I may say that when we began our investments there with an investment of a million dollars, we did not do it on the advice of people in whom we did not have the utmost confidence. We have employed and have had the services, during the past four months, of the most eminent engineers that can be hired to do that sort of thing; and I believe that no matter how eminent the men may be that are employed by this commission or by the shipping interests that they will agree with our engineers that our work is not going to interfere with navigation.

Mr. TUTTLE.—I do not dispute at all the quality of their engineers. I have no doubt they have got the very best. That is why they require to be watched. They are their brains, not ours, and they require to be watched.

The CHAIRMAN.—I think the commisssion quite appreciate the point. Are there any others?

Mr. KING.—On behalf of the Dominion Marine Association I wish to say something that has not yet been said; that is to return the thanks of perhaps the majority of this meeting, particularly of the vessel interests west of Montreal, to the commission for this opportunity not so much of repeating our protests as of learning some little bit of what is going on. We feel that it indicates

very heartily the desire of the commission to do what is right. Not that we ever had any doubt about that. We realize, perhaps more to-day than we did before, the doubt that may have existed as to what is right; and I want to say how glad I am that you, Mr. Chairman, voiced at the opening of your remarks the principle which governs the commission in its actions, and which heretofore has not been so plainly and explicitly voiced in the press. I am delighted, and I am sure the Marine Association will be delighted, to hear that the principle that governs will be the preservation of navigation interests as paramount; not the sharing of the rights in the water between navigation interests and development interests, but the recognition of the paramount right of the navigation interests. One has only to look at the enormous expanse of the great lakes to realize the tonnage that passes through the Sault canal—so many times greater in a year than that which passes through the Suez canal—to feel that the St. Lawrence river is the coming link, the high road to the sea from those lakes. When we realize that the government has spent millions of money to get a channel which is measured, not in feet, but sometimes in inches, to say that taking an inch from the depth now available for navigation is a very serious thing to contemplate, and one that I am glad to see the commission does not intend to contemplate for a moment, even at the immense advantage to be gained in the development of the water-powers of the country. The St. Lawrence is too important to deal with in any other way. In the light of that fact, it seems hardly necessary to say anything more. We are leaving the matter in that way—we should be content to leave the matter entirely in the hands of the commission, because if they are not going to see the rights of navigation interfered with, we have nothing more to say. We only wish to point out, as I did in a couple of questions to-day, the varied interests from the navigation point of view. Those rafts that come down here are not only cases interesting to Canadians, but a great deal of that timber that came down recently was shipped from Virginia, and to avoid the difficult haul to the Atlantic ocean it was sent all the way around Toledo, down Lake Erie, through the Welland canal into Lake Ontario, and was made up into rafts to come down here and reach the Atlantic ocean. We are not entirely through with our rafting business in Canada. Mr. Smith may show us something from his point of view as to spoiling one of the principal assets of his company at present; but our main point is the passage of the great volume of freight from the interior of Canada down to the ocean. Montreal, of all places, is interested in putting forward a resolution very much opposed to that advanced by Cornwall. I can sympathize heartily with Cornwall. I have been in my own city council at home; but we feel that the other interests are paramount, and that the depriving of a barge or package freighter or any vessel that now leaves Fort William, or Kingston, or Prescott, with grain for Montreal, the taking of an inch or so off her available draught in passing down the St. Lawrence, or the stealing of two or three hours of her time in going down or in going up, is a matter of such importance that we wish the Commission to devote all their available resources to ascertain whether or not that will be done before they assent to such a scheme as this. With regard to the gentlemen who opened for the company, Mr. Foster, I am sure that if I were counsel for one company or for another, I would not for a moment resent the suggestion that both sides would have to be heard from. There has been a suggestion thrown out that our criticism was unfair, or might be unfair, or was intended to be unfair. I am sure that Mr. Tuttle and the others interested have merely intended to advance the view that they wish protection; that they do not wish interference with what are considered their vested rights; and if the commission desires that the vested interests should appoint engineers to advance their views the same way as they have been advanced on the other side, I am sure that can be done. But if that be not done, then we simply say we wish to rely entirely on the good faith of the commission.

The CHAIRMAN.—Mr. Smith do you desire to say anything?

Mr. C. J. SMITH.—Yes, sir. In the first place, the Long Sault being one of the chain of rapids, is one of the principal assets of our company. The engineer for the Development Company stated that that might be offset by those dams and those hydraulic works. We have those in existence to-day, and we do not find that the people are nearly as anxious to go up the canal as they are to come down the rapids. If the precedent was established that the Development Company could be started because the Long Sault rapids gave that opportunity it might go down to the other rapids and develop them in the same way, and leave the Richelieu and Ontario Company without its established route, and leave the country without, what we consider for the country at large, up to the present time, a much more valuable asset than the one they are proposing. Furthermore, that is a navigable waterway to-day, not only for the boats of the Richelieu Company, but for boats of that draught. The question may arise, as it is up in our minds to-day, as to whether it cannot be utilized to a greater extent than it is to-day. Certainly any benefits to our company by shortening the canal westward and by creating these works, is, in our opinion at present, with the limited opportunity we have of studying it, of course, more than offset by the loss of the rapids to us. It simply wipes them off the face of the earth and puts a complete dam across the St. Lawrence river. As I am not an engineer, I could not say what the effect would be if anything gave out in any of those dams, that is an engineering problem that will have to be considered. From the standpoint of the Richelieu and Ontario Navigation Company at the present time, we are decidedly against usurping those natural channels for the use of private corporations.

Mr. HUGH ALLAN.—I have been asked to put before you the views of the Shipping Federation of Canada, representing all the ocean liners running to this port, with the exception of the Canadian Pacific. You have told us that these improvements will not affect the depth of water below these dams. That was our principal point. The other point is that these improvements will not make more expensive the use of these waterways so that traffic of all kinds in present use will be brought to Montreal and taken from Montreal as they have been heretofore.

Mr. O'CALLAGHAN.—Not only the town of Cornwall, but also the counties of Stormont, Dundas and Glengarry, fronting on the part in dispute, support these improvements. I wish to call the attention of the commission to the work being done by the Ontario government in regard to harnessing Niagara falls. We have just as good a power at the Long Sault and in the town of Cornwall. I wish to state to the shipping interests here that while they consider those paramount, we have also interests in Eastern Ontario which must be considered in these matters and we are also willing to consider them. But as far as we can see into this matter, we are going to benefit the shipping interests by shortening the route in the Cornwall canal. I do not think it is necessary for me to take up any time of this commission to show that all Eastern Ontario are heartily in accord with this scheme of harnessing the Long Sault in order to make Cornwall what it should be—the factory town of Ontario.

Mr. G. W. STEPHENS.—I have listened with a great deal of interest to the different points of view that have been laid before this meeting. I have the honour to be one of the Harbour commissioners in the port of Montreal, and I would simply like to place their views on record—that they look upon the St. Lawrence from the ocean to the great lakes as a national highway belonging to no section in particular, but to the whole Dominion; and the first and foremost point to be settled, beyond all peradventure, is that between the great lakes and the sea there shall be no barrier of any kind placed across that river, whether it be a bridge, or a dam, or a development of any nature, which will,

under any conditions, interfere with the depth of the water in the channels, upon which the people's money has been spent so lavishly.

CHAIRMAN.—You can take that for settled. The commission have settled that beyond peradventure. The only point now left is just this. The commission desire to assist public improvements, and where they can be made without injury to navigation they will be permitted. (Hear, hear.) The condition at Niagara falls is entirely different; there is no interference with navigation there. Now, it is asserted by the promoters of this scheme that it will not injure but that it will assist navigation and they have their engineers to give their opinion. It seems to me that a practical ending of this matter now, would be to suggest to the representatives of the Board of Trade, the Harbour Commission and the Marine Association that they should agree as speedily as possible upon one or more engineers, and suggest their names to the commission, and I have no doubt that the government will authorize the commission to pay the expenses of investigation. Let us have the benefit, at any rate, of their opinion. We may not agree with that. We may think that the experts for the company are more correct in their views, but I think we ought to hear evidence from both sides. The Premier of the country has taken the stand that there must be no action, such as this obstruction in the river, until it is ascertained beyond any doubt that it will not interfere with the interests of navigation. I am very glad that our commission has had the opportunity of meeting the members of the Board of Trade and the other interests. I think if you agree with my suggestion, and would submit the name of some expert, it could do no harm, and it would be perfectly fair that he should report and perhaps meet us at a later date. If he agree that no harm will be done it will not be necessary to meet. If he differs from these gentlemen, our commission would be very glad to meet you again at a later date, and let us hear them thresh it out, and perhaps get other opinions. I think it is an exceedingly important matter, and should not be lightly dealt with. I think you can trust the commission that they will deal with it after being fully advised in the interests of the general public.

Mr. ROBERT SMITH (Cornwall).—I just wish to thank you, on behalf of the citizens of Cornwall, for your very courteous hearing. If transportation can be protected and this development go on it will benefit everybody. (Hear hear.)

CHAIRMAN.—We are all agreed upon that.

Mr. FOSTER.—Let me say on behalf of the St. Lawrence Power Co., that so far as the power company is concerned we recognize the very deep debt of obligation that we are under to this commission, and to the gentlemen who compose this audience, for the opportunity of meeting and discussing this matter. We never expected for one moment that we were going to be permitted to put these works up, if it was going to interfere with the interests of these men; and we are glad to meet these gentlemen and discuss this matter, and we will be glad to put before any engineer they may select every bit of information we may have at the first moment, so as to come to the very best conclusion.

Mr. KING.—The gentlemen were so positive as to the effects of their works, and the non-interference with navigation interests, that possibly the matter might be simplified by some obligation entered into, to the effect that no interference would take place.

CHAIRMAN.—No, that is not practicable.

Mr. FOSTER.—We would be willing to do that.

CHAIRMAN.—I do not think that is practicable at all. You cannot give permission and then interfere with it afterwards. If it is going to interfere with navigation it should not be permitted. If it does not interfere it may be permitted.

Hearing closed at 11.30 A.M.